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EDITORIAL NOTES.

Gas Statistics for the Strike Year.

By the issue of the Board of Trade returns relating to the operations of gas companies during 1912 and to local authority concerns during the year ending March, 1913, we have before us the statistical history of the gas industry (other than the non-statutory part) for the year of the great coal strike. The year, of course, must be taken as an abnormal one; and this is illustrated in several ways. Though here and there a full supply of gas was not maintained during part of the strike period, the year disclosed an all-round increase in gas consumption exceeding 5 per cent. The big expansion of receipts, however, did not balance additional expenditure; and the average make of coal gas per ton dropped to a very detrimental degree below the figure of the preceding three years, during which the yield per ton had been gradually ascending.

We will deal with the last point first. The total quantity of gas made in the year was 215,492,714,000 cubic feet, which was an advance of 9,876,688,000 cubic feet; and here it may be mentioned as a point of interest that the increase in the quantity of gas paid for was 9,875,920,000 cubic feet, so that the addition to the sale was not far below the addition to the make of gas. Of the total quantity produced, 188,351,688,000 cubic feet were coal gas, and 27,141,026,000 cubic feet were water gas—the coal gas made showing an increase upon the previous year of 7,420,274,000 cubic feet, and the water gas of 2,456,414,000 cubic feet. It is curious, however, to note in this connection that, notwithstanding the pressure for coal during the year, the water gas made by the local authorities (6,026,092,000 cubic feet) was less by 222,224,000 cubic feet than in the year preceding; while the quantity made by the companies (21,114,934,000 cubic fect) was 2,678,638,000 cubic feet more. The additional coal gas made (7,420,274,000 cubic feet) was produced by the companies to the extent of 3,766,685,000 cubic feet, and by the local authorities to the extent of 3,653,589,000 cubic feet. The quantity of coal carbonized was 16,052,487 tons, which was an increase of 417,475 tons. Dividing the make of coal gas (188,351,688,000 cubic feet) by the tonnage of coal used, we have an average yield per ton of 11,110 cubic feet, which, as already intimated, is the worst figure for the past four or five years. Going backwards, the average makes per ton in the preceding three years were 11,572, 11,383, and 11,160 cubic feet. The 11,110 cubic feet, we may here confess, was at first, on making the calculation, a little surprising; seeing that every cubic foot of gas possible was required in the strike year from every ton of coal carbonized. But when one remembers how the coal-stores were scraped clean of stock that year, and some of that stock old and deteriorated, and how those who had to buy just prior, during, and immediately after the strike, were glad to get hold of any stuff (and some of it very poor) from which gas could be made, the reduction of 480 cubic feet on the average is, partly at any rate, explained. Had the average make per ton been the same as in the previous year, only 224,015 tons of coal extra would have been required, instead of the extra 417,475 tons, notwithstanding the 7,420,274,000 cubic feet additional of coal gas made.

The reduced make of gas per ton of coal was a serious tax on part of the industry ("part" seeing that the average hides the companies that did very badly, and those companies that did well in the make per ton), just as was the fact that, although the receipts for the year (£34,268,370) were in excess of the preceding year by £1,949,600, the whole of this increase and £15,274 besides were swallowed up by the year's expenditure, which amounted to £26,030,179—the balance between revenue and outgoings for the year being £8,238,191, as compared with £8,253,465. We fear that the next returns will bring still less comforting figures in respect of this point as to expenditure, in view of the costs of coal and oil during 1913, from which high costs relief is only promised at the end of the current half year.

But meanwhile the returns for 1912-13 are gratifying as to the course of the gas business. Although only four additional small concerns are included in the returns, the capital and borrowed money employed (£137,461,970) increased by £1,364,042. The number of consumers (6,876,149) shows an advance of 226,245; and the number of public lamps (735,121), an increase of 6573. Sales of gas (198,922,469,000 cubic feet) were greater than in the preceding year by 9,875,920,000 cubic feet. The number of the companies' consumers was 4,062,289, or an addition of 155,761 consumers; while the number of local authorities' consumers was 2,813,860, or an increase of 70,482. This is all highly gratifying; and there is another very satisfactory feature. The average consumption of the companies' gas consumers was 31,010 cubic feet, and that of the local authorities' consumers 25,914 cubic feet—a difference between the company and local authority average sale per consumer of 5096 cubic feet in favour of the former, which is an improvement from the side of the local authorities upon the 5238 cubic feet of the previous year. But the average consumption per consumer is on the up-grade. In the case of the companies, the increase in the average is 421 cubic feet; while in the case of the local authorities it is 563 cubic feet. When it is remembered that these last two figures respectively apply to 4,062,289 and 2,813,860 gas consumers, they indicate that a large business is being secured that is an advantage from the capital point of view. There is nothing so profitable as doing greater business through the existing service-pipes, meters, and accounts. Though the local authorities are still far behind the average of the companies in sales per consumer, in 1912-13 they had the encouraging satisfaction of beating the companies in the increase put on to the average.

These are the main features of the Board of Trade returns for 1912-13. Our reading of the statistics is that had it not been for the coal strike and all that it involved, the year would have been one never excelled in the history of the industry. Business expanded throughout. But the cost of material and the lower quantity of gas realized from the coal used did the financial mischief to which attention is called in this examination of the returns.

A Critical Position at Dublin.

The time has now arrived for the shareholders of the Alliance and Dublin Consumers' Gas Company to seriously consider the present position of the concern, take deliberate action, and not allow themselves to be overruled by the Board, or unduly led by self-appointed committees of shareholders, nor be swayed by any consideration till they know precisely where they are, and have had an opportunity for proper determination as to the right course to pursue. The ordinary meeting of the shareholders has been called for next Tuesday; and we hope that a very resolute stand will then be made to secure two things that are, in our opinion, absolutely essential in the present unhappy position of the concern. These two things are: First, the circulation among the shareholders of the report of the two experts (Mr. William Newbigging and Mr. W. R. Herring) who have been inquiring into the affairs of the undertaking, and into the circumstances that have brought it to the present miserable situation, and, secondly, time for the consideration by the shareholders of the report, and for coming to a conclusion as to what is desirable in the interests of the concern, of the shareholders, and of the gas-consuming citizens of Dublin. We sincerely hope, now that events have come to the present head, that the shareholders will not be misled, and think that the critical position is one that can be remedied merely by the simple plan of infusing some new blood into the directorate. It depends entirely on the character of the blood whether any good will be accomplished by it; and this is strikingly emphasized by the first point

we desire to make, that the Directors of the Company have resolved to do their utmost to make a secret document of the experts' report.

Why should the Directors desire to keep the contents of the report secret? Let the shareholders ponder well this question. The Board appear to consider that the shareholders will be satisfied by the simple—simple in more ways than one—statement that the experts' report has been received, and that they (the Board) will take its recommendations into serious consideration. It is also stated in another quarter that "it is not in the best interests of the share-" holders that it [the report] should be distributed broad-" cast." Why? The quoted words appear in a circular issued by Mr. F. J. Dickens, who has been prominent as a shareholder in producing the investigation, and we ask this gentleman for an answer to our interrogation. There is not anything that the report can reveal that would make the situation worse for the Company than it is at the present time—with the shares in the market at half the value at which, under other circumstances, they should stand, with a dividend of only 2½ per cent. now being recommended, and with the price of gas at the figure charged in Dublin to-day. On the contrary, we believe that the very best interests of the concern would be served by the circulation of the document among the shareholders. It would supply the strongest possible guide as to the course it is desirable to take in the present crisis. What is there that the Directors have to hide? There must be something which carries some reflection on men, policy, or administration, or there would not be this anxious desire for secrecy. It is the business of the shareholders to get at the root of this matter.

Palpable it is to everyone who is in the position to form judgment that the undertaking has been drifting. We do not say that it has been wilfully allowed to drift. But it has been drifting badly, or it would never have got into its present state. And the shareholders have a perfectly indisputable right to know more about the whole matter, and independently of the Board. They were promised by Mr. Dickens, before the inquiry was instituted, a copy of the report of the expert appointed for the purpose (on permission being obtained from the Board) of making an investigation on behalf of the shareholders. The Directors subsequently also appointed an expert to act with the one nominated by Mr. Dickens; and later the Directors passed a resolution "that the fees and expenses of both experts " should be borne by the Company." The move was doubtless regarded as a protective one against publicity. On the strength of it, the Directors now claim that no one has the right to circulate the report without the authority of the Board. The shareholders will be very foolish to be brushed aside in this manner. If the fees and expenses were paid by the Company, then the report belongs to the Company, and not to the Board. The shareholders, under the circumstances, should compel disclosure; for no greater harm can possibly be done to the concern than has already been accomplished. The desire of the Board to keep the report secret is in itself a matter that does not look well, and from more points of view than one.

In the Company, there is a large body of British shareholders; and in London, Scotland, and Lancashire, Shareholders' Committees have been formed, and each Committee appears to have selected its own candidate or candidates for positions on the Board. In this matter, we do urge the shareholders to exercise the greatest prudence, and not allow themselves to be rushed into anything, but to consider very gravely what is the order of man and knowledge that is particularly required at the present time on the Board of the Company. It will be seen from our "Correspondence" columns to-day that Mr. H. E. Jones, who was the recognized consulting, but not advisory, engineer to the Company, and whose work as consultant appears to have been limited to dealing only with matters specially referred to him, has severed this connection—an erroneous impression having got abroad that his advisory work was continuous, and not merely intermittent as sought. Now, in our opinion, what is absolutely required by the Company in the present crisis is not a consulting engineer, but a strong, technically and commercially qualified Managing-Director in the chair of the Company. The position, we are fully satisfied from what we know as to the affairs of the Company, is one that needs something more than the inclusion of fresh business men on the Board. Nothing short of a Managing-Director experienced in large gas-works construction and distribution, competent in all branches of gas trading, and one who can give time on the spot, over a substantial period, to the work of reformation—and it is onerous and long work that lies before—will meet the situation. The man required for such a position, too, is one of marked individuality in technical and commercial gas work, and not one who would be content to be merely a pawn on the directorial board. The means to the desired end must be of a robust character; nothing else will suffice. Unless such means are brought into being, and that now, we warn the shareholders that they will live to regret the neglect of an exceptional opportunity to do something that will—with hard work, time, and proper direction—place the Alliance and Dublin Company in the position it should properly occupy as the gas undertaking serving the capital city of Ireland. The experts in their report say that "unsatis-" factory as our report indicates the position to be to-day, " it is not past remedy." Let this be borne in mind by the shareholders; and let them ask themselves what is best to be done to realize the proper remedial measures. We feel confident that our suggestion points in the right direction. Upon what is done now much depends.

Flames.

As is the custom with the Society of British Gas Industries, the President (Professor Harold B. Dixon, Ph.D., F.R.S.) delivered his address last Thursday as the penultimate act in his year of office. The system has its advantage and its disadvantage. It is an advantage in that, if the address is not all that the President would like it to be, the memory of it does not accompany him as a nightmare through the presidential year. The system has the disadvantage that, if the address is excellent in matter and composition, and forces itself upon general attention, the President has not its support—it being almost of a valedictory nature—from the inauguration of, and during, his year of office. It was a large audience that assembled to hear the learned address by Professor Dixon, notwithstanding that it was known that he had intended to take for his theme the initiation and propagation of flame—a subject that he has made largely his own in this country, and the subject that has made his name famous the world over. If there was not complete understanding of the more abstruse parts of the address by the whole of the members present, there was on their part an obvious admiration of their President; for, as he proceeded—largely without the assistance of his prepared address, in a dark room, and by the aid of lantern slides and screen—to dilate upon the chemical combination of gases, ignition points and temperatures of gases and flame, the propagation of flames through explosive mixtures, specific heats of gases at high temperatures, and other problems and phenomena that surround these matters, the whole appeared to him, but to few others, as simple as ABC. Yet, after his almost life-long work in the patient investigation of these subjects—an investigation with little hope of material reward other than the satisfaction of having drawn fresh knowledge from the occult—he has to confess he has not yet mastered all that he desires to know. In fact, the work appears to be infinite; for fresh discovery opens up fresh problems, and presents new difficulties. In some way or other, and at some time or other, all these succeeding discoveries find a place in which they will fit and be of service. It was so with Professor Smithells' discoveries relating to the structure of bunsen flames; and, more than ever before, Dr. Bone's researches into the chemical combination and combustion of gases in connection with heated surfaces promise to open up new fields in which the discoveries of science will in the world's affairs ultimately serve important practical ends.

All manufacturers of gas-using appliances—from burners, through heating appliances and furnaces, to gas-engines—are interested in the subject of flame, and so are all manufacturers who require heat in their manufacturing operations. Those present during the delivery of the address, while finding interest in its every part with the enlightening lantern illustration, no doubt detected in it many a practical point that will have its bearing upon the future of gas application. There are still many things which it is desirable to know in connection with the combination and combustion of gases, and the elucidation of which will assist the future. Some of the problems were stated by Professor Dixon in the form of questions, and he proceeded to show how far, from the laboratories of the Manchester University, have come the answers, and what still remains to be done. Of this we are convinced, that the personal work of Professor Dixon, and of those over whom he has exercised his

influence and direction, will point the way to greater issues in practical work, though exactly in what way must be left to the discoveries in application. Obscure points in connection with the combination and combustion of gases have had light thrown upon them at the Manchester University. Surface, or flameless, combustion has been with us now for some time through the work, from scientific research to practical application, of Dr. Bone and his associates. This work has itself opened up fresh ground for research; and such research has been proceeding at Manchester. It is now regarded as old knowledge that chemical combination occurs between gases in contact with heated surfaces a long way below the temperature of ignition. But working with Dr. Coward, Professor Dixon has quite lately shown that contact with a heated surface raises the temperature of ignition, and that the heated surface prevents combination becoming so rapid as to develop into flame, which would have been produced earlier had the surface been absent. This suggests that, although the solid with which the gas comes into contact is heated well above the ordinary ignition point of the gas, the flame does not really appear at the ignition point, but at such higher temperature as the gas attains by pre-flame combustion. The great capacity of the solid for heat compared with the gas in contact with it keeps the temperature down, and so acts as a brake on the chemical combination. This explanation by Professor Dixon throws additional light on the effect of the heated surfaces upon the combining gases, as well as on the actions operating in the production of flameless combustion.

The difficulties attending the ascertaining of the temperatures of gas mixtures is discussed in the address; the main trouble being that the heat capacity of gas is small, while that of the walls of the containing vessel is large, and thus there are considerable losses. But from the sudden compression method of heating-up gas mixtures, and calculating the temperatures before there is any appreciable loss to the walls of the vessel, have come several interesting disclosures, one of which is that the preconceived idea is quite erroneous that, when gas is compressed and heated to the ignition point, the flame must spread through the gas as an explosion wave. The Manchester experimental work has shown that, by arresting the piston in the compressing chamber at the moment the gases are compressed to ignition point, the flame appears, after an interval, at some spot in the heated gas, and spreads throughout the mixture. But the flame does not start as an explosion wave. Such work as this must of necessity be of great practical use in connection with the solution of the problems that surround gas-engine practice, as also would be more exact means of obtaining knowledge of the specific heats of gases at high temperatures. This latter is a subject that has baffled many observers. There cannot be any great reliance on the heat capacity of gases measured at low temperatures, from which curves are drawn upwards outside the range of the experiments. But Professor Dixon is rather more hopeful to-day of realizing a mean approximation of the specific heat (at the temperature of the experiments) of gases in a tube by ascertaining the velocity of sounds in a heated gas. His long experience in measuring explosion waves makes him confident the rates of sound can be measured within 1 per cent. However, the method of measuring the velocity of sound waves is one of great delicacy; and much difficulty has been encountered in trying to obtain a tube which would stand the experiments without disaster. The last silica tube, however, has stood the experimental usage of the past twelve months; and from the comparative values of different gases, it is hoped to draw data that will serve the end in view.

We trust the outcome, and that soon, of this quest for scientific knowledge will be of real practical value, and all that, and more than, Professor Dixon at present hopes for. He is sanguine of success. "I believe it to be true," he writes, "that we are to-day within measurable distance of "arriving at a clear understanding of the temperatures "and pressures reached in gaseous combination—an under- "standing which must be to the advantage of those whose "business it is to develop heat and light from gases." The Manchester University stands in the midst of one of the most opulent industrial areas of the country: and the plea of Professor Dixon for a still larger connection between the research work carried on there and the industrial work of the immediate outside world ought to awaken a very large response.

Causes Affecting Beneficial Effects of Municipal Gas Trading.

It is not often that Mr. Robert Watson, of Doncaster, is disappointing in anything that he does; but we are a little disappointed with his paper read at the Manchester District Conference of the British Commercial Gas Association last Tuesday. It is to be feared, too, that Mr. Watson himself is not altogether satisfied with it. It was the difficulty of the subject with which he essayed to deal, and not any shortcoming of his own, that leaves a feeling that the paper does not offer much in the way of remedy for a state of things that admittedly is not in the best interests of municipal gas undertakings. The introductory fact faces us that the municipal gas undertakings of the country show an average gas consumption per consumer of about 5300 cubic feet a year less than that of the statutory gas companies. Mr. Watson inquires how this is. He shows what an excellent thing it would be for the municipal gas undertakings to get level with the statutory company undertakings in this respect; additional consumption by existing gas consumers being business involving small increase of charges of any kind other than manufacturing, which would also derive some benefit. But he does not disclose in the paper any very definite means by which there could be, under present conditions, any comprehensive removal of the causes that have conspired to prevent the average consumption per consumer of municipal gas rising to the same height as the company average. This, and in no other respect, is where the paper does not satisfy; and it is the very issue from the criticism that the author makes of municipal conditions for which we looked.

The real weight of the communication lies in the condemnation that it supplies of the restricting circumstances of municipal trading enterprise in such a commodity as gas. It is seen how the municipal gas undertaking—there are exceptions where the authorities are superior to local feeling on the subject, and live it down—is curbed at every turn by the conflict of its own immediate interests with those of the ratepayers who engage in the sale of fittings, or who as gas-fitters and plumbers partially derive their profit from this class of work. This seems to be the one thing that places a paralyzing hand upon the extension of the activities of many of the gas departments of municipal corporations, and which deters them from working to attain a full measure of trading success, or rather as full a measure as can be realized while, in cases, profit appropriation in aid of the rates forms part of the municipal policy. The same progress, generally speaking, has not been made as with companies in getting into closer touch with the consumers, and developing the use of apparatus and methods for obtaining the greatest use of gas and the highest efficiencies from that use. The local bodies are afraid to do this or that in this direction on the ground that they might provoke unpleasant relationships with a few of the ratepayers. A greater body of ratepayers than the few trading ratepayers concerned are distinctly and directly affected by this condition of things, through being, by an acknowledged neglect, debarred from getting all they might receive by the extended enterprise of the gas departments in this connection; while the entire community is affected by the limitation of the rate of progress towards a purer state of things atmospherically by the displacement of solid by gaseous fuel. Minorities have their rights; and so have majorities. And we have yet to learn that the rights of the majority of the ratepayers must suffer owing to the lower efficiency of the ratepaying traders than of the gas department in bringing about at greater speed a higher and broader service to the community generally. The whole position is a singular and an anomalous one, and a reflection, where the condition exists, upon the municipality as a legitimate trading body.

But let us suggest that there are other reasons for the existence of the difference of 5300 cubic feet as between company and municipal sales per consumer. One is the favouring of the newer and less productive electric undertaking. The nourishing of municipal electricity concerns has been one of the singular spectacles of modern municipal management. To afford sustenance to them, methods have been permitted which have attacked the interests of the gas undertakings, with their greater financial soundness, labour-giving capacity, and direct service-rendering power. In saying this it is not, of course, meant that there should not be electricity supply undertakings; but their management certainly should not be conducted on lines with the

obvious intent to do the maximum injury to the undertaking, and to reduce its service to the minimum without any proportionate benefit either to ratepayers generally or to the electricity concern. There is another thing that has often struck us as being to the detriment of municipal gas enterprise. A gas company has offices of its own; and independent show-rooms scattered here and there. The whole atmosphere about company conducted gas enterprise is that of an ordinary commercial business—approachable by the consumer, at all times and for any purpose, with the same freedom that he or she would go to his or her butcher, grocer, tailor, or draper. But in the case of some municipal gas departments, what do we find? Around them there is the atmosphere of local government. Government, and not business. The offices are, as a rule, in the municipal buildings, where reside all the power and glory of local government. The gas department's offices and the chief officers, and the secretarial and commercial staffs, are often under the same roof as the police, the rate-collecting, the sanitary, and other departments—both legitimate and illegitimate—of municipal activity. The whole atmosphere, we say, is one of government and not of commerce. Find the gas department a house of its own in a main thoroughfare of a city or town, and surround the place with the atmosphere of a huge business establishment, and things would, we are confident, go along much better and more progressively.

At the same time, the committees who administer gas departments for the greater part realize the restrictions that the superior power of the whole governing body places upon them. They would willingly branch-out to greater things if they could act independently. But they cannot. Many of them, especially in Lancashire and Yorkshire, are doing a good part in bringing their influence to bear in the national publicity and educational work of the gas industry. The committees where there has been continuity of administration know as well as the directors of some well-managed gas companies what is the real need of the times for the undertakings entrusted to their management, but entrusted under paramount control by the whole council. And this, in numerous cases, is the bar to a greater activity. Mr. Watson recommends the arriving at some mutual arrangement with local gas-fitting firms and traders in gas appliances; but that is but a poor compensation to a gas department's own freedom. He also advises the supervision of piping of houses. Many a local authority has the statutory power to do this; comparatively few there are who exercise it. And why? The same reason—the fear of cutting across the grain so far as the local traders are concerned. He further urges local authorities to do their part to support the movement for the better training of gas-fitters; and he also recommends differential prices. But in these things does he get at the real root of those causes that act as trammels to the best and highest service of gas departments? We opine not; and, after reading the paper, there is confidence in saying neither does Mr. Watson.

Koppers' "Combination" Gas and Coke Oven.

In other columns, there is an article by Mr. G. Stanley Cooper, F.C.S., &c., descriptive of the new type of Koppers carbonizing oven for gas-works. It is what is known as the "combination" oven; it has already been installed; and it is working quite satisfactorily, at, among other places, the Koenigsberg Gas-Works. But we are a little doubtful as to whether this new form of oven has any material advantages for gas-works purposes over the Koppers horizontal chamber type of oven as installed at Birmingham. The title "combination" oven is derived from the fact that it can be operated either as a gas-oven or as a coke-oven—being in the former case heated by gas from a central producer, such as the Mond, and in the latter case by the rear portion of the gas—that is, the poorest part to the amount of 50 per cent. of the total gas production—resulting from the carbonization of the coal. This latter gas can also be stripped of benzol by scrubbing with creosote oil. From the British gas-maker's point of view, we cannot see the advantage of being in a position to change, as suggested, from producer gas to the absorption for heating of 50 per cent. of the gas yielded by the coal carbonized. In the first place, the primary half of the gas yielded can, for town distribution purposes, very well do with the dilution of the second half, as is proved by the analyses and calorific tests of the bulk of the gas made in the form of ovens in use at Birmingham and other gas-works. In the second place, gas-works do not, as a rule, carbonize to primarily produce coke; and they are not likely to produce it in this country in excess of the requirement for gas. They find as it is that the coke heap has a disposition to increase in its girth through the enlarging demands for gas, and the call for coke in these times not proceeding *pari passu* with the supply. It is not at all probable therefore that British gas-works will be in any way desirous of disposing, in heating the ovens, of part of the gas supply from the coal carbonized. What they are more likely to do is (as it is not expected that ovens of the kind even in the large works will completely displace ordinary retort, horizontal and vertical, operation) to cause regulation to fall on the supplies of the two grades of coke—the household variety from retorts, and the denser variety for industrial use from the ovens. With a margin of carbonizing power divided between both systems, it would be quite easy to meet coke requirements up or down just as they varied as between industrial establishments and households. Moreover, it appears to us that the capital expenditure on the "combination" oven would be somewhat greater than that on the horizontal chamber oven as at Birmingham—perhaps not much, but still an appreciable amount, and that to secure something which does not appeal to us as valuable under British conditions. The information that Mr. Cooper gives as to the Koppers' process for the direct recovery of ammonia is an interesting addition to the article; but, as recently said, we are looking forward to receiving some definite particulars from actual working. With Mr. Cooper we feel that direct ammonia recovery is a system that is now within measurable distance of a larger adoption on gas-works; but what is wanted to give a fillip to the adoption are actual working details.

The Suggested Central Council.

No actual official announcement has yet been made as to the outcome of the discussion of the question of the formation of a Joint Council representative of the whole of the interests of the gas industry. But the following significant statement fell from the President of the Institution in his speech last Thursday at the annual dinner of the Society of British Gas Industries: "Although a scheme for the formation of a Joint Committee which would represent the whole gas industry is for the present in abeyance, the spirit of the movement is alive and strongly in evidence." The subject was under discussion at a private sitting of the members of the Society during the afternoon, upon a report presented by the representatives of the Society on the Joint Committee of the three organizations—the Institution, the Society of British Gas Industries, and the British Commercial Gas Association—who were elected to consider the matter and to report. We will not comment upon the position of the question pending an authoritative declaration, except to say that, in addition to Mr. Allen's statement referred to above, rumour has been very busy that the inclination is in the direction of maintaining the present independence—pursuing the work for which each body was respectively formed, and rendering the same co-operation that has made such a marked success of the industry's organized work during recent years. However, as we say, there is not at the moment any official announcement on the subject; and until one is available, and there is something definite to discuss, the matter may be left.

The B.C.G.A. Local Conferences.

The members of the Society of British Gas Industries have done very large service in connection with the financing of the work of the British Commercial Gas Association; and care ought to be taken not to give rise to any grievance, on the ground of the neglect of the members. There is abroad a little feeling that the Society might have had greater recognition paid to it in connection with the recent local conferences of the Commercial Association, by the firms whose works are situated in those divisions receiving invitations for a representative to attend. We believe members of the Council of the Society did receive invitations. But the same courtesy was not extended to the other members in the divisions concerned. We have to remember always that the British Commercial Gas Association stands for more than any one interest in the industry. Of the Association, gas undertakings only form part; and, therefore, all the subscribers to the latter in a division should have received an invitation to the conferences.

Perhaps there has merely been an oversight. If so, it is to be hoped that a similar mistake will not be made at any of the future conferences.

A Reduced Assessment.

The Torquay rating authority have come rather badly out of their encounter with the Gas Company of the town. Instead of sustaining the increased rateable value which they attempted to place on the undertaking, they have had to admit that the old valuation was excessive, and refund a part of the rates which had been paid during the past eighteen months. This is a decided victory for the Company, and not the less notable and worthy of commendation because it has been achieved without the cost and risk of legal proceedings. The course taken by the Directors seems to have been a very proper one under the circumstances. When they received notice that the assessment was to be increased, they sought expert advice, and decided to resist the advance as an unreasonable imposition. The Assessment Committee must have had some doubts on the subject; for, instead of carrying the matter into Court, they entered into negotiations, and finally admitted that the old assessment was £400 in excess of the correct amount. The incident is not without value as a lesson to others. In these days of ever-growing municipal expenditure, there is a natural disposition to assess all property at the utmost limit of value, and perhaps a little beyond it. The burden of the rates presses heavily upon everyone; but it is the obvious duty of those who have the control and management of big industrial concerns to see that they are not unduly penalized for the relief of the rest of the community. The Torquay Gas Company might have gone on for years paying more than their just share of the rates, but for the ill-advised action of the Assessment Committee in trying to make them pay still more. A company carrying on business in competition with a municipal electricity undertaking is specially bound to see that it does not suffer from any handicap which the municipality may put upon it through the rates.

Miners' Minimum Muddles.

It is getting quite a common thing again to see references in the newspaper press to disputes in which coal miners are concerned; and an article from the pen of an expert correspondent of the "Financial Times" is couched in none too hopeful tones when dealing with the early future. It is pointed out that a dispute under the Minimum Wage Act which has led to a strike at several collieries near Rotherham, and now threatens to involve the entire Yorkshire coalfield, is just the kind of dispute that may be expected in nearly every mining district when depression comes, and prices and wages can no longer be maintained at the current high levels. It is, of course, correct that during the period over which the Act has been in force trade conditions have been good; and if there has been discontent under the measure with high prices and wages, things are hardly likely to improve in this respect with the coming of far less prosperous times. In fact, the opinion expressed in the article is that there would already have been several minimum wage strikes had it not been for the fact that the national strike left many of the local unions in a very nearly bankrupt condition; and with the union funds accumulating again, and the prospect of an early decline in coal prices, the labour outlook has become distinctly threatening. In the last few days there have been strikes at some of the South Wales mines; and a spread of the movement is hinted at. Meanwhile, a Miners' Federation conference has been held, at which it has been decided that action shall be continued locally in the various districts to obtain a settlement of the proposals for increased wages and improved conditions of employment for the surface workers on the pit banks. This line of action has been adopted rather than having recourse to the threat of another national strike—which was favoured by a section of the men.

Profit-Sharing and Co-Partnership Abroad.

Students of labour subjects will find much valuable material in a report which was issued a few days ago by the Labour Statistics Department of the Board of Trade on "Profit-Sharing and Labour Co-Partnership Abroad." It has been found that each of the countries included in the report has followed its own line of development; and there are accordingly many notable divergencies presented. France possesses a far larger number of schemes than any of the other countries; and many of them are of very long standing. France is also noteworthy as possessing some of the most famous examples of profit-sharing extant in any country. In Germany, profit-sharing has made little progress; and many of the schemes introduced have been comparatively short-lived. In the United States, too, only about twenty-five or thirty firms have been reported to the Department as practising profit-sharing and co-partnership; and most of these have only started their schemes within the last ten or twelve years. On the whole, the report states, it would appear that profit-sharing is not regarded with very great favour in the United States, either by manufacturers and business men or by economists; the principal reasons being the attitude of the trade unions and the preference of employers for other means of improving the position of their workpeople. As regards the British Dominions, it seems that profit-sharing, as understood in this country, has scarcely obtained any foothold in Australia and New Zealand or in South Africa. It has made but little more progress in Canada; and one of the principal schemes formerly existing has been abandoned.

DEATH OF HERR WALTHER FELD.

We regret to record the death, on Sunday, the 15th inst., of Herr Walther Feld, whose name has during the past ten years been a good deal before "Journal" readers, in connection with his processes for the purification of gas and sulphate manufacture.

Rather more than twenty years ago, Herr Feld started business works at Hoenningen-on-the-Rhine, now known as the Chemische Fabrik Hoenningen und vormals Messingwerk Reinickendorf R. Seidel Aktiengesellschaft; and it was he who first manufactured the precipitated pure barium carbonate on a large scale. His connection with these works was severed when the concern was formed into a large company. His attention was then turned to the manufacture of barium peroxide, and works for the purpose were erected at Hoenningen. Further research work then led him to deal with the recovery of cyanides from coal gas, and this again to the idea of purifying gas by his now well-known special washer, utilizing the sulphur in the gas for the manufacture of sulphate of ammonia without the aid of sulphuric acid—by the polythionate process. The Koenigsberg Gas-Works were the first in which experimental plant was erected to test the process; and a report thereon by Professor Dr. Bunte caused the authorities to decide on larger works, producing about 5½ million cubic feet of gas, and these are in course of erection. Other works where this process has been adopted, and which are being put up, are one coke-works in France, for 1200 tons of coal; one coke-works in Germany for 1600 tons of coal; and one works in Germany for the production of 5 tons of sulphate of ammonia daily from producer gas.

Herr Feld was an indefatigable investigator, working day and night on the various processes to which his attention was directed. The nature of these will be gathered from the following list of his principal patents. He was all his life a hard worker; and his death will be very much regretted.

1897.—Obtaining barium oxide, &c.
1901.—Hydrocyanic acid and its recovery (three patents).
1903.—Treatment of coal gas or other gases containing cyanogen for obtaining soluble cyanides.
1904.—Treating coal gas and other gases containing ammonia and cyanogen for the extraction of the ammonia and cyanogen therefrom, and the partial regeneration of the agents employed in the extraction.
1905.—Treating coal gas to extract tar and ammonia.
1906.—Producing ferrocyanides from cyanogen contained in gases.
Treatment of gases for the extraction of ammonia.
Treatment of coal gases for the recovery of tar and ammonia.
1907.—Regulating the pressure of gases flowing through flues or mains.
Washing out ammonia from coal gases.
Treatment of coal gas to obtain tar constituents and ammonia.
Purification of distillation gases.
1908.—Treatment of sulphur dioxide and sulphuretted hydrogen to obtain sulphur.
Subjecting gases or vapours to the action of liquids.
1909.—Obtaining and utilizing sulphur from sulphuretted hydrogen and sulphur dioxide.
1910.—Extracting tar from gases.
Centrifugal washer (French patent).
1911.—Effecting the combination, with sulphurous acid, of ammonia and sulphuretted hydrogen contained in gases, &c., and obtaining ammonium sulphate.
Production of sulphurous acid from sulphur.
1912.—Effecting the mutual reaction of sulphuretted hydrogen and sulphurous acid.
Production of sulphur and sulphates from polythionate solutions.

During the past ten years numerous references to Herr Feld's plant and processes have been made in the "Journal," apart

from the publication of the abstracts of the specifications of his patents. In an appendix to an article by Mr. Thomas Holgate, on "Gas Purification by Ammoniacal Liquor," which appeared in August, 1904, the writer called attention to Herr Feld's method of quantitative analysis for sulphur. A year later, a comparison was made between the Feld and Bueb methods for the extraction of cyanogen. This was followed by an article furnishing particulars of Herr Feld's process for the extraction of ammonia as given in the specification of his French patent. Towards the close of 1907, Herr Feld's washer was described in a paper on "Cyanogen Extraction" read by Mr. C. H. Edmonds, of Birmingham, before the Midland Junior Gas Association. The apparatus was also referred to by the then Chief Inspector under the Alkali Act (Mr. R. Forbes Carpenter), in his report for the year named. He said the washer appeared to be so applicable to a variety of operations that it was to be hoped it might soon receive introduction into this country. This hope was shortly afterwards realized, for in the summer of 1908 a number of gas engineers and others interested in the subject were afforded by Messrs. R. & J. Dempster, of Manchester, an opportunity of inspecting the first washer built in this country, as well as of examining the constituent parts of one of the appliances then in course of construction. A full account of this visit was given in the "JOURNAL" at the time; and the opinion was expressed that there was concentrated in it more interest for the gas technician than was sometimes to be drawn from a whole formally arranged meeting for the discussion of the ordinary technical and commercial topics which engage the attention of the engineer and manager of a gas-works.

Referring to Herr Feld's washer in the course of his Inaugural Address to the Institution of Gas Engineers a few weeks previously, Mr. W. Doig Gibb said it would probably be of considerable service in ordinary gas purification and for the recovery of many bye-products; and he added that its use would "help towards the ideal condition of continuous purification *in situ*." The attention directed to Herr Feld's washer brought us a letter from Mr. William Key, who claimed that it was almost identical in design with his gas-washer described to the North British Association of Gas Managers in 1888; but Herr Feld's agents, in reply, suggested that he should inspect the working section of the washer at the works of Messrs. Dempster, and they thought he would then realize that it introduced an entirely new method of treating gas, and was a great advance upon all previous machines.

The next important stage in connection with the introduction of the Feld plant into this country was reached in September, 1909, when an installation at the East Hull Gas-Works was inspected by the members of the Eastern Counties Association of Gas Managers. In view of this visit, a description of the plant was specially prepared by Herr Feld. In referring to it as the greatest novelty in the whole proceedings at the meeting, and, at the moment, "in the whole range of plant employed in British gas-works," we pointed out that it had to "prove its title, under British gas-manufacturing conditions, to superiority over the existing system, of effecting the same purpose." This superiority had to be proved from the twin points of efficiency and economy. We said that if Herr Feld had succeeded in producing a plant, self-contained, in which a cyclical action proceeds without waste and with economy, without the escape of anything but innocuous gases, in which the unpurified gas enters, the sulphuretted hydrogen is totally eliminated, and the sulphur removed as a solid precipitate, he would "deserve the highest esteem of the gas industry," for it would give to it "the direct marketing of a readily selling product."

In subsequent volumes of the "JOURNAL," articles appeared dealing with Herr Feld's French patents for extracting tar and its constituents from gas and for his centrifugal washer. A translation was given of an article by him in the "Zeitschrift für angewandte Chemie" on the extraction of ammonia from gas; and also of a paper read before the Italian Gas and Water Works Association in September, 1912, by Sig. A. Pacchioni, on the thionate process for the manufacture of sulphate of ammonia. There were three points in this paper which Herr Feld considered required correction; and he mentioned them in a letter which appeared in the "JOURNAL" for July 15 last year. Towards the close of his communication he expressed the opinion that the process in question had a great future before it, seeing that it would in all probability solve the problem of the nearly complete wet extraction of sulphuretted hydrogen, and thus do away with about nine-tenths of the cumbrous and troublesome dry purification. In an editorial article in the same issue the claims put forward for his process by Herr Feld were discussed and compared with other purifying processes then engaging attention, especially the direct sulphatation system. The conclusion was come to that he was putting his claims too high; but it was acknowledged that the thionate system was a very fascinating one, as were most of the proposals with which Herr Feld had been intimately associated. In a letter which appeared in our columns a few weeks later, he replied to some of the criticisms offered, and explained that he did not intend to have the calculations in his previous letter based on results which, though they had been obtained by experiments on a large scale, and would assuredly be borne out by plants in course of erection, had not been proved by plant in continuous operation.

Herr Feld's processes are now before all who are engaged in the technical branch of the gas industry. Their author is unfortunately no longer with us to aid by his advice in carrying them out. Whether they will prove to be superior to those in present use from the two points to which reference has already been made—viz., efficiency and economy—time alone will show. In any event, acknowledgment must be made of the patient investigations of which they are the result.

OBITUARY.

The death is announced of Mr. P. J. EATON, who last November retired from the position of an Alderman of the Macclesfield Town Council. For many years he was Chairman of the Gas Committee, and otherwise took a great part in the public affairs of the borough.

The death occurred on the 13th inst., at Moss Side, Manchester, of Mr. WILLIAM SEVERS, who retired in 1911 from the position of Manager of the Wilmslow and Alderley Edge Gas Company—a position which he occupied for many years. The interment took place last Tuesday at the Birstal Parish Church.

The death has occurred at Teignmouth of Mr. FRANCIS FOX, M.Inst.C.E. Deceased, who was 95 years of age, was engaged as Engineer in the construction of several gas-works and railways in South Wales and Cornwall. He also constructed works for the Bristol Town Council, and extensive undertakings on the River Frome.

PERSONAL.

Mr. C. V. BENNETT, who, in September last, entered upon his duties as Engineer of the Rochester, Chatham, and Gillingham Gas Company, has now been appointed, in addition, General Manager to the concern.

Mr. JOHN WOOD, of the Gaythorn station of the Manchester Corporation Gas Department, has been appointed successor to Mr. Frank H. Robinson, Assoc.M.Inst.C.E., in the position of Resident Manager of the Knutsford Gas and Water Works. It will be recollected that Mr. Robinson was recently appointed Engineer and Assistant-Manager of the Harrogate Gas Company.

At the Birmingham Central Laboratory, Nechells Gas-Works, last Friday, members of the chemical staff gathered together to wish Mr. F. C. ROBINSON, Works Chemist at Adderley Street, good luck on his obtaining a similar post with the Preston Gas Company. Mr. W. A. Twine, the Superintendent of the chemical plant, took the chair (in the absence of Mr. E. W. Smith, the Chief Chemist), and referred to the ability shown by Mr. Robinson, who was presented with a suit case, a pipe and tobacco pouch, and a letter suitably worded and signed by all the members of the staff present. Mr. Robinson has been with the Birmingham Corporation Gas Department for eight years. His place at Adderley Street is being taken by Mr. W. J. SAVAGE.

NOTES FROM ABROAD.

Progress in Japan.

The "Journal of the Imperial Gas Association of Japan" for February emphasizes the necessity for the education of consumers in the use of gas, and deplores the backwardness of the gas companies in this branch of propaganda work. They appeal to the companies to take up lectures and demonstrations, and also to institute complaint departments, not so much because the companies give bad service and cause of complaint, but because the public in their ignorance make mistakes and lay the blame on the suppliers. This branch is not entirely neglected, because the companies in Kyushu Island recently provided a travelling demonstration vehicle for increasing the sale of heating appliances. The Journal hopes this example will be followed, and that the industry in Japan will soon be on an equal footing with western countries in this important branch.

Coal and Dividends.

Like most other gas makers in the world at the present time, the Japanese are not satisfied with their coal industry. An estimate has been made by the Government of the available native supplies. In the year 1912, the import was 300,000 tons, while the export increased by 17 per cent. to 3½ million tons. Since then prices have been rising. The output for the last ten years has increased at the rate of 7·3 per cent. per annum, the consumption by 9·5 per cent. To meet the home consumption, an increased output of 8 million tons annually will be required. Gas business seems to be satisfactory in spite of this. Of the companies which held meetings at the end of the year, 17 are reported as having declared dividends averaging 7 per cent.—none of them neglecting their reserve funds. The highest of these paid 11 per cent., and the lowest 4 per cent.

Bread Baking by Gas.

The result of the bread-baking competition instituted by the Minneapolis Gaslight Company, of which mention was made in the "JOURNAL" some weeks ago, has just been announced. Some idea of its popularity may be gained from the fact that no fewer than 1800 samples of bread were submitted, weighing over 5000 pounds in all. The bread had to be baked in a gas-stove oven in the city, and each contestant was only allowed to submit one loaf. Members of the families of gas company employees and

professional bakers were not allowed to compete. Cabinet gas ranges were awarded as prizes, and the bread was distributed among the city charities.

German Meter Exports.

The number of "Wasser und Gas" for March 15 contains an article on this subject, some details from which are interesting. Germany is said to have sent to Great Britain, Belgium, France, Austria-Hungary, and Russia 621 tons of gas and water meters, in the year 1913 of which Great Britain is supposed to have received 39 tons, or very nearly double the quantity received in 1912. Dissatisfaction is expressed with the East European market, but great things are hoped for from Canada and the United States. "In Canada," says the article, "our goods are known as the cheapest in the world." Italy, Holland, Spain, and Japan received between them 164 tons of meters in 1913.

Large American Coke-Oven Plants.

It is claimed that the largest coke-oven and bye-product plant in the world is that of the United States Steel Corporation at Gary, Ind. This was built by the H. Koppers Company, of Chicago, in 1907. It has 500 ovens, and last year produced 48,000 million cubic feet of gas, 22,300 tons of sulphate of ammonia, and 11 million gallons of tar. The entire steel works are operated by the surplus gas, and it is estimated that 3000 tons of coal are saved daily. It is now announced that the contract for what will be the second largest plant in the world has just been secured by the same firm. It is to be erected for the Bethlehem Steel Company, and is to consist of 424 ovens carbonizing 5000 tons of coal daily. The ovens will extend in two rows for a quarter-of-a-mile.

Determining the Colour of Light.

In a paper read by Dr. L. Bloch before the German Illuminating Engineering Society last November, the author reviewed existing methods of determining the colours of artificial light sources, and described in greater detail a simplified process for representing them numerically and graphically. In this, the proportions of red to green light, and of blue to green, are taken by three photometrical measurements, and the figures so obtained regarded as a measure of the colour of light, taking daylight with a clouded sky as unity. At the end of the paper are given the measurements for a large number of ordinary artificial lights, determined by this method. The same process, says the author, can be used for the numerical description of the colour of any desired material.

A Curious American Specification.

The local authorities of Fairbault, Minn., recently drew up regulations for the local Consumers' Power Company. After fixing the maximum price at $1 (4s. 2d.) per 1000 cubic feet, the specification contained the following: "And shall be of the pressure, purity, candle power, or heating value, and shall comply with the latest requirements and notifications of the Gas Referees, covering Metropolis Gas, London, England." The local gas company will no doubt be quite content with this, since American standards are usually fixed higher than the English. But it is questionable whether some of the progressive American gas men will be pleased with this reference to a London authority.

Netherland-Indies Gas Company.

This Company last year celebrated the fiftieth anniversary of its foundation, and in commemoration of the event an exceedingly handsome brochure has been issued, of which we have received a copy. It is illustrated with numerous beautifully tinted pictures of buildings, plant, native working staffs, &c., and with plans and diagrams. Most interesting, perhaps, to "JOURNAL" readers is a group of the Directors, which forms the frontispiece, among whom is seen the General Manager, de Heer Knottnerus—known to many from his frequent visits to English meetings. An account of the development of the Company and its works is given, the latter being situated at Batavia, Soerabaja, Semarang, Buitenzorg, and Paramaribo. The electricity works at Batavia are also in the hands of the Company. The gas consumption rose from about 43 million cubic feet in the year 1884 to 240 millions in 1912, and since 1863 the price has fallen from 16s. 8d. to 6s. 8d. per 1000 cubic feet.

The Strassburg Gas Contract.

In the "JOURNAL" for March 3 was given in these columns a note on the new contract made between the town of Strassburg and the Continental Union Gas Company. A writer in the "Frankfurter Zeitung" recently described the contract as of great importance to the finances of the city. It is expected that a 10 per cent. increase in rates will be saved, which had been contemplated by the authorities before settling the new contract. According to the present rate of increase of the consumption and other business, and provided prices remain as they are (13 pf. per cubic metre), there should be a total net profit of Mk. 12,981,000 up to the year 1932, when the old contract would have expired. On the new basis of reckoning, the Gas Company will receive Mk. 4,826,000 of this, and the Municipality Mk. 8,155,000. But besides this, the town takes 10 per cent. of the gross income, which will bring the total of their income from the gas undertaking up to Mk. 13,595,000. The new Company to be formed will be called "Gasanstalt Strassburg A.G.," and being a German concern, will obviate the hitherto frequent complaint that German capital was going abroad.

NOTES FROM WESTMINSTER.

LAST week was quite a busy time in the Committee Rooms. As will be seen in the following notes, certain Bills were disposed of—satisfactorily to the promoters, though with a little lopping off of proposals here and there. Besides the Bills specially dealt with to-day, proceedings commenced on the Skegness Gas Company's Bill, which will be followed by that of the Purchase Bill of the District Council; and there will be matter for comment next week in regard to these promotions. There is also interest in the Newport (Mon.) Corporation Bill, in the electricity supply section of which the Gas Company are concerned. The Bills that have been before Committees in the course of the week in which there are calorific power clauses are going forward on the understanding that there shall be compliance with the decision come to on the Gas Light and Coke Bill. In the Bedwas and Machen District Council Bill, which has been before the Unopposed Bills Committee, a calorific power clause is included, on the lines of the Porthcawl and South Suburban Acts; and this Bill has been ordered for third reading, but it did not transpire whether there was any agreement to defer the clause for any modification (if any), in accordance with subsequent decision. In the case of the Riddings Bill, the promoters informed the Unopposed Bills Committee that they were prepared to adopt any model calorific clause that might hereafter be instituted. A few water measures have been under discussion; and a convenient opportunity will be taken to make some notes upon them.

The Accountants' Question.

The chartered and incorporated accountants' organizations have had their first brush with the London Association of Accountants before a Select Committee over the parliamentary recognition that the last-named body desires in the special purposes fund clause and the clause restricting auditing to professional accountants—a subject which was discussed in the "JOURNAL" for March 3 (p. 570). The matter arose on the Whitwell and District Gas Bill, the clauses in which had, at the request of the Association, been altered by the promoters in their favour. The model special purposes fund clause, it will be remembered, had also been modified, at the instance of the Association, so that it read: "The fund shall be applicable only to meet such charges as an accountant appointed for the purpose by the Board of Trade shall approve." We will not discuss the matter again, beyond saying that the prescription as to appointment by the Board of Trade establishes a clumsy method while two such bodies as the chartered and incorporated accountants are in existence; and that these two bodies (membership of which is open to all qualified professional accountants) would in the future, as in the past, suffice for parliamentary companies. In financial matters, these companies want the very best professional and (gas companies especially) specialized assistance; and they have confidence in the two principal organizations, without a third one coming in. The members of the Association who are qualified for membership of the two older bodies can put themselves right in this matter by becoming members of one or the other of them. In the Whitwell case, Lord Haversham and his colleagues settled the point at issue by ordering the modified model special purposes fund clause to be inserted, which leaves the appointment to the Board of Trade; and that is an unnecessarily circuitous process.

Clearing up the Brentford Case.

There was an adjustment of the clauses in the Brentford Bill on Monday of last week; but the number of local authorities asking for all sorts of things almost exhausted the patience of Lord Hylton, who, with his colleagues, had the previous week given so much time to a full hearing of all the opposition cases, which had been presented in a somewhat discursive manner. The new site, as recorded in last week's issue, was a loss to the Company, who will we take it soon be looking about for another one. The new capital is to be restricted to £310,000, with one-third borrowing powers. The principal matter discussed on clauses was the electric supply provisions. The Company, it will be recollected, obtained all they desired in this regard; but on clauses the Hammersmith Borough Council and other electricity-supply authorities tried to squeeze some of the freedom out of the powers sanctioned by the Committee. Hammersmith did not want the Company to be in the position to apply for powers in territory adjoining the Borough Council's present area of supply. Although the Council have no powers in such districts, they wished to have them preserved until such time as they may think fit to offer a supply. There seems to be some strong resentment on the part of electricity suppliers to have to compete with gas companies for rights to supply electricity—probably because, as in the case of the Tottenham Company and the supply of Wood Green, gas companies can contract to give better terms, owing to their peculiarly favourable position. Lord Hylton would not consent to any such restriction as was desired by Hammersmith, nor would he hear of the Gas Company being prohibited from negotiating for the purchase of existing electricity undertakings. All he was prepared to agree to was precisely what the Company had suggested, and that was that they should not apply for powers in any area within which an existing undertaking had been authorized to supply electricity. There was a limitation

put upon the laying of pipes for the conveyance of residuals. The power has been limited to half-a-mile from any "gas-works," which reduces the power of subterranean distribution for storage purposes, as the half-mile is not to refer to a storage station away from the gas-works.

County Councils and Pipe Laying.

This perennial question—which is most important to gas companies—came up again on the Kidsgrove Gas Company's Bill. The Company and their Parliamentary Agents and advisers (Messrs. Lees and Co.) are to be congratulated upon offering the stout resistance they did (with Mr. Balfour Browne, K.C., as leading Counsel) to the Cheshire County Council and the Staffordshire County Council, instead of doubling under as have certain other gas companies when County Councils have tried to gain advantage in excess of their general law rights, and to place all possible burdens and restrictions upon gas undertakings with regard to their use of the subsoil of main roads. In the Bill is a clause dealing with the laying of pipes for ancillary purposes; and the Company also propose the construction of new works in Staffordshire and the extension of the limits of supply in Cheshire. Upon these proposals, the County Councils hung their plea for extraordinary privileges. The main roads in Staffordshire are repaired by the urban district councils, except as to half-a-mile; but the main roads in Cheshire are maintained by the County Council. In the result, the Staffordshire Council were sent empty away by the House of Commons Committee presided over by Sir W. Howell Davies; the Cheshire Council got some conditions, but nothing of the onerous order they sought. They spoke of the change of traffic circumstances, and of the necessity for building stronger roads; but the very fact of stronger road crusts is a protection to the pipes beneath the surface, and, with such strengthened crusts, the Council will have less to fear as to damage to pipes. But the fact of the matter is County Councils wish to be protected against the increased weight and crushing power of their own steam-rollers, and to be relieved from any damage to underground property that they may occasion. In this case, they wanted to get a greater depth prescribed for the laying of pipes; but several Select Committees session after session have refused this. A greater depth than this was prescribed in the case of the Wandsworth Company in 1912; but, from what subsequently transpired, we are confident that the Committee who so prescribed an unreasonable depth in that case afterwards saw the absurdity of it. In the Kidsgrove case, all the Cheshire County Council got was the right to prescribe the position of new pipes or pipes that are being relaid, in main roads (with reference to two Justices in case of difference), but they are not to prescribe the depth. In alterations by the Council to main roads or bridges, the Company are to remove their pipes if desired, while the Council are to defray the expense of so doing, and give the Company accommodation for maintaining by temporary expedients the supply of gas. The Company are not to open a greater length than 100 yards of roadway at any one time; and we do not suppose they ever desire to do so. Notice of road openings is to be extended from the ordinary three days to seven days, which, save in emergencies, is not a great hardship, although sometimes an inconvenience to consumers. Practically all this the Company were prepared to concede. Mr. James Beech, the Manager of the Company, gave evidence.

Discs and Prepayment Meters.

The recent trouble and prosecution at Manchester, regarding the use of discs in prepayment meters, are called to mind by a clause which the Kidsgrove Company have succeeded in getting into their Bill. The clause makes it a punishable offence to place in a prepayment meter anything other than coin of the proper denomination for the gas supplied. The actual wording is as follows: "Any person who causes or suffers to be placed in any prepayment meter (as defined in the section of this Act of which the marginal note is 'Charge for Gas Supplied by Means of Prepayment Meters') belonging to the Company any disc, token, coin, or thing other than a coin of the value and denomination for which the prepayment meter is designed and intended, shall be liable to a penalty not exceeding twenty shillings."

Too Much Mud.

Of all the wearisome days spent in Parliamentary Committee rooms, those devoted last week to the hearing of the case for and against the Leyland Gas Company's Bill would be hard to beat. In the olden days, had there been, on the part of an opposition, such prolixity over a lot of small detail as there was in this instance, some of the long-experienced and hardened Chairmen of Committees would have indicated their displeasure in proper terms and manner. The Leyland Company—represented by Mr. Honoratus Lloyd, K.C., and Mr. Jacques Abady—put their case very succinctly; but, on the other side, the rearing of mountains out of mole-hills was extremely well illustrated. If ever a Company was painted with a bad character, the Leyland Company was last week. It did not seem to have done anything right; and, in fact, those responsible for its conduct were totally unaware that they stood so badly in the sight of the Council until they got to Westminster. They were told that they had exceeded their powers, had been working in a financially unsound manner, were a nuisance, and really were little short of thieves so far as the slot-meter consumers were concerned. It was, indeed, a very bad character that Mr. Thomas Duxbury—one of the Directors—listened to as he sat, on the edge of the Press table, apparently not very much concerned over the allegations. The case in opposition was all much overdone; so much so that Mr. Mount and his colleagues apparently did not give any considerable credence to it—at all events, they found it rather paltry stuff, some of which had obviously been brought together for the purpose of obtaining a purchase clause, which was not granted. The Company, in the result, walked off with their Bill simply minus the electricity powers, two townships were knocked out of the extended area at the request of the West Lancashire Rural Council, and a bit was taken off capital powers owing to the curtailment of area. In the extended district the Company are to lay mains within five years.

Electricity Powers Refused.

It would be interesting to know why the Committee refused the electricity powers, seeing that there is now so much precedent for such authorization being given to gas undertakings. The old argument that the dual power in the hands of a gas company stifles competition was rebutted by the testimony of Mr. A. H. Dykes, an electrical engineer who has had much to do with the obtaining of electricity powers by gas undertakings. His evidence was that, in areas such as this of Leyland, the gas company can supply cheaper than an independent electricity concern; and the fact that, in cases with which he has been associated, both gas and electricity supplies expand, shows that any fear as to stagnation existing, in the absence of separate competing concerns, is purely a myth. Another curious thing about this rejection is that the District Council have allowed their own Provisional Order to lapse; so that they evidently did not think much as to the prospects of electricity supply in Leyland. As a matter of fact, it looks very much as though little else than an industrial load could be obtained in the district. Why, therefore, the Council should have opposed something that certain people believed would have been a benefit to the industry in their administrative area is one of those strange movements on the part of local authorities that have no reason in them. They seem to oppose almost any and every thing—however good—simply because a company are the moving spirits. The witnesses for the Bill were Mr. Francis Elliott (the Manager of the Company), Mr. William Cash, F.C.A., Mr. Samuel Tagg, the Engineer of the Preston Gas Company, Mr. Henry Woodall, and Mr. A. H. Dykes. For the Leyland authority, evidence was given by Mr. Robert Porter and Mr. E. H. Stevenson; while Mr. W. M. Carr, the Engineer and Manager of the Ormskirk Gas Company, gave evidence, on behalf of the West Lancashire Rural Council, as to the proposed extension of territory.

Limits of Supply.

As already seen in the notes on the Leyland proceedings, the Company have had a time-limit of five years placed upon them within which they have to lay pipes in the extended area of supply; otherwise, if anyone else is prepared to furnish a supply, Parliament will look with benevolent eyes on their proposals. This, as we have before pointed out, is a new feature in granting fresh territory, as Parliament is not prepared to countenance a "dog-in-the-manger" policy in regard to statutory territory which is undeveloped. But the Ellesmere Port and Whitby District Council, in trying to take away from the little Sutton and Hooton Gas Company the right to supply Overpool (which right was conferred five years ago) were, under the circumstances, exceeding what was fair. The five years coincides with the time-limit placed upon the Leyland Company; but there was no such limitation put on the Sutton and Hooton Company in 1909, and moreover the local conditions ought to be taken into consideration. The residents at Overpool have not asked for a supply of gas; and there are only a few houses in the district. But the Company's mains have been laid in that direction, of the size requisite for extension as soon as the conditions favour. Lord Balfour of Burleigh's Committee, therefore, were not prepared to deprive the Company of Overpool; and so the Bill of the Ellesmere authority (by which they will purchase the Shropshire Union Railways and Canal Company's local gas-works) goes forward without the coveted piece of area. They have also voluntarily relinquished Backford. The Council are taking power to supply electricity. Mr. William Newbigging gave evidence for the Bill; and Mr. W. M. Carr for the Sutton and Hooton Company, which his father was instrumental in establishing. The Southbank and Normanby Bill, which is to define the area of the Company, and to extinguish powers in part of their supply area possessed by the Middlesbrough Corporation, came before a Committee during the week, but was soon put into the position to proceed. The Middlesbrough Corporation, in regard to gas supply, have always shown a disposition to act fairly towards the Companies supplying on their borders in whose areas they have overlapping powers. In this instance, Mr. Balfour Browne, K.C., was able to show that this disposition continues, and a smart agreement ended any opposition to the measure.

Amending the South Suburban Bill.

The South Suburban Gas Company are proposing to make certain amendments in their Bill on Petition for Additional Provision. On inquiry of the Parliamentary Agents (Messrs. Dyson and Co.), we learn that the object of the amendments is to include part of the Parish of Shoreham in Kent in the Company's area of supply, and to apply to the parish the provisions as to calorific power standard, instead of illuminating

power standard, which apply to the "specified districts" referred to in Part IV. of the South Suburban Gas Act, 1912. The only other point with which the additional provision deals is to make it clear that any differential prices charged in outlying parts of the Company's area of supply shall not be regarded in calculating the dividend payable in accordance with the sliding-scale.

ELECTRICITY SUPPLY MEMORANDA.

THE "Ulster" of the electrical industry, as represented by the Electrical Contractors' Association, has declined with thanks the revised version of the Electric Wiring, Fittings, and Loose Finance Bill of the Incorporated Municipal Electrical Association, and has decided upon hostile measures if there is any persistence in attempting to push the Bill forward. So national political history finds a parallel in a section of industrial history. The official organ of the Electrical Contractors' Association says certain things about the Bill which, if they were not true, would be extremely rude. It asserts that the new proposals are "absurd and unworkable," and that "it is impossible to deal with such nonsense." That high authority on good manners—"Meteor" of the "Electrical Times"—says that "such remarks as these embody not merely doubtful manners, but bad tactics." As the remarks in question are closely akin to those made in the "Memoranda" last week, we might, if the side of "Meteor's" past that has turned up most conspicuously before us had been of a contrary nature, have seriously taken his reproach as also applying to us. But on re-reading the Bill since our comments of last week, all we can say is that those responsible for the modifications intended to appease the contractors must have had a poor opinion of the intellect of the latter if they thought that such milk-and-water proposals were going to satisfy; and, if they did so think, as seems probable, then the fact does not add lustre to their own mental powers. The electrical papers appear to have all, with more or less warmth, accepted, the revision as a real and satisfactory attempt at compromise; and they recommend the contractors to swallow the thinly jammed pill. "Meteor" goes farther, and, in effect, says the contractors must voluntarily swallow it, or take the consequences. The consequences are that the thin coating of jam will be removed, and resort will be had to a process of "forcible feeding." There is a good deal of lightly covered menace in such words as these: "A further contingency worth noting is that, if the contractors persist in their present attitude, the concessions embodied in the Bill may be withdrawn, and unfettered wiring and hiring powers, on the lines of the London County Council Act, substituted." Again, the Bill "has powerful and growing influences behind it, whereas the present policy of the contractors is more likely to lose them support than to attract fresh adherents." If "Meteor" studies closely all that happened in connection with Sheffield, under the peculiar circumstances of the case, he may perchance detect something in the nature of "powerful influences" at the back of the position taken up by the contractors.

The Electrical "Ulster."

There has been very little opportunity of judging what would have happened had the chronological positions of the advent of gas and electricity supply been reversed. Had public electricity supply been in the field first, and gas had subsequently come along and installed itself with, from the outset, its present recommendation of economy and efficiency, would there have been a large turnover from electricity to gas? We have not the slightest doubt that gas would have got a good proportion of the lighting, and had a walk-over in all operations in which heat is required. But, as we say, the evidence is not great upon which any definite opinion can be founded. But there are two instances at hand bearing upon the subject. In our "Notes from Abroad" a fortnight since, reference was made to what has been happening in the picturesque little town of Geisenheim in the Rhine district. For about ten years, the town has been suffering from an electricity supply monopoly; and complaints of bad lighting and of the inconveniences of breakdowns were rife. Electricity was in very bad repute; and the Municipality took the enlightened course of installing a gas supply. The result was the expected one. Quickly, on gas being available, 80 per cent. of the houses were connected-up to the supply mains. We come nearer home, and have before us the tale told concerning Ashington (Northumberland) in our "Notes from Westminster" and "Parliamentary Intelligence" last week. There is a district that has had from a Colliery Company, according to the evidence given before a Select Committee of the House of Commons, a partial and much-neglected gas-supply, with an electricity supply run first, and with the favour of the Colliery Company upon it, by the Northern Counties Electric Supply Company, and then by the Newcastle Electric Supply Company. There, again, complaints of bad lighting were common; and charges were considered to be too great for the light afforded. Some 2992 houses were wired for electric lighting (mostly occupied by colliery employees), 2261 houses were lighted by oil, and only a paltry few by gas from the insignificant plant on the Colliery Company's premises. But not all the occupiers of houses that were electrically wired used the electric light; and—mark this!—2173 of them have signified their willingness to take gas now that the District Council are asking power from Parliament to make of Ashington a civilized place by providing a supply of gas. The Electricity Company and the Colliery Company appeared willing (we gather from the evidence of Mr. Arthur Valon and others) to do anything to stop the coming of proper gas competition; and the figures quoted show that they have good cause, when dissatisfaction abounds, and people are possessed with the desire to have gas. Admittedly these are small illustrations; but they do not show, had electricity supply preceded gas supply, that, on the entry of the latter, electricity supply would have been in such favour that gas would have stood no chance.

If Electricity had Been First.

There is a statement in a recent number of the "Electrical Review" which we think our contemporary should justify or withdraw, as we are convinced that one of three things has happened. It has been the victim of an over-enthusiastic showroom attendant or office boy who was not very scrupulous as to the truth, or it has gravely blundered itself, or it has deliberately (which we cannot believe) told an untruth. We are all at times guilty of error; and it has been found in the past that the "Review" cannot claim to be exempt from ordinary—occasionally extraordinary—human mistakes. It has recently been writing somewhat exuberantly on the subject of an exhibition the South Metropolitan Electric Light and Power Company have been holding at their show-rooms at Lewisham. Showrooms are, as a rule, for permanent exhibitions; and so we take it that, at this particular time, the display was of a special order. In the course of its descriptive article, the "Review" states:

Will the "Review" Explain?

> Competition with the South Metropolitan Gas Company is especially keen; but during last year the Electric Company established a record increase in consumers, lamps, and net revenue (the latter has increased 50 per cent. during the last three years), and doubtless yet more rapid progress will be the reward of the present campaign. *Houses of £26 per annum, or even lower rental, are being "electrified" by streets at a time.*

We have no complaint to find with the statement as to competition being especially keen with the South Metropolitan Gas Company. This goes without saying where that Company are concerned. But the point for which we desire justification or withdrawal is this: "Houses at £26 per annum, or even lower rental, are being electrified *by streets* at a time." The statement is untrue. Saying which, we have the greatest confidence in asking the "Review" to name the streets to which it refers. Those streets are not in the South Metropolitan Gas Company's area. It might be, unless we forestall any such subterfuge, that our contemporary would suggest an error had been made, and that the South Suburban Gas Company's area, in which the South Metropolitan Electric Company also supply, was intended. Let us say at once, that no houses in the South Suburban Company's area of £26 or any other rental, are being electrified "by streets at a time," or anything like it. Under their statutory powers, the Electric Supply Company have to send the South Suburban Gas Company notice of every service they are about to lay down in their gas supply area; and, for the last twelve months, the total of these was about 100—the services being in two or threes in various parts of the district. Pretence of greater success than is being achieved is the height of folly; seeing that the pretence can be so easily undermined. Now will the "Review" kindly answer our question, or withdraw the statement?

The Rejected.

The commercial departments of gas undertakings frequently have experience of the substitution of electric-radiators by gas-fires. The Southampton Gas Company are not an exception to the rule. A long time ago, before the public had heard any mention of the proposal of the Corporation Electricity Committee to increase the hire charge for radiators, and to make it an obligation on the users to keep them for a definite period, the return of radiators had set in; and this despite the ½d. per unit charge for current used for heating. The point as to when radiators commenced to find their way back to the Corporation Electricity Department should be borne in mind, because "Meteor" in the "Electrical Times" has been trying to fasten the responsibility for the radiator rejections on Mr. Kimber, the Chairman of the Corporation Electricity Committee, owing to the fact that he "stoutly championed," and that publicly, an increase of the ½d. per unit for heating purposes, which charge he did not consider sufficient. Already, by the beginning of February, some 160 radiators had been returned. What is there astonishing about this, after people had been shivering in front of the radiators during the snaps of cold weather that had been experienced? "Meteor" quite overlooks this, as well as the time when radiators from electricity users' houses began to slip back into the department's stores. He manifestly thinks that the increased rentals, and apprehension of a rise in tariffs, are the sole causes. We are equally confident that they are not. There is also "a rapid increase in the return of other apparatus as well as radiators." Further endorsement that we are right and "Meteor" is wrong, is supplied by a report said to have been recently issued by the Electricity Department. It is assumed in the report that the return of radiators and other apparatus is due to the uneasiness prevalent among the consumers at the present time over the

question of tariffs. But the report before us proceeds: "Letters and calls have been made, but no tangible result has occurred beyond the unfortunate fact that the apparatus is being returned." If only misapprehension existed, and not discontent, these "letters and calls" would surely have removed it. But they did not, and the users seemed heartily glad to get rid of the radiators and other apparatus. We cannot blame them.

The Fixed Price.

Regarding the question of obtaining the custom of working men, it is noticed that the Dover Corporation are longing to try the fixed price system for the supply of current to some cottages for lighting purposes. It is an experiment that is in complete discord with business principles. In his report on the matter, the Electrical Engineer (Mr. Woodman) suggests that the cottages shall be fitted with five lamps—a 25-candle power one in both the parlour and the kitchen, a 12-candle power one in each of two bed-rooms, and an 8-candle power one in the passage. With the five lights going at once, in one hour one-tenth of a unit of electricity would be used; so that with ten hours' use of the five lamps a unit would be consumed. Mr. Woodman thinks that, at 6d. per week, "a very good return" would be obtained from the free use of the lamps by the cottagers; the 6d. including cost of installation and upkeep. We wonder what made him come to this conclusion. It would be interesting to learn. He knows the conditions better than we do; and yet we do not hesitate to say that 6d. per week is not going to pay.

Halfpenny per Unit for Lighting.

In last week's "Memoranda," the electricity supply position in London was briefly described. It is a singular position, in which the suppliers of electricity, the County Council, the Corporation, and other authorities are all pulling in contrary directions, and in this way are hoping that something definite and beneficial will result. It is a peculiar method, but there it is. Among other points mentioned a week ago was that Mr. Merz (who was a few years since so prominent in connection with the power schemes for London) has been consulted by the County Council, and has prepared a report on the whole problem. Mr. G. H. Hume, the Chairman of the Electricity Committee of the London County Council, has evidently read Mr. Merz's report, and has been so much struck by its contents that he has publicly stated that we are on the eve of big things so far as the electricity supply of London is concerned, and whatever arrangements are come to, they will undoubtedly result in users of both light and power getting current very cheaply—he hoped before many years at 1d. or ½d. per unit. It was just as well to provide breathing space by using the words "before many years."

Defective Comparisons.

The danger of drawing conclusions, and making comparisons of statistics that are not fully understood, has been exemplified by the "Financial Times," in commenting upon the Statistical Abstract for London for 1912-13, which has been issued by the London County Council. Our contemporary says that the reduction of the average price charged by the London gas undertakings between 1903 and 1912 has been less than 13 per cent.; while the reduction in the average charge shown by the quoted municipal electricity supply undertakings during the past ten years, and by the quoted company electricity undertakings during nine years, has been upwards of 50 per cent. There is really no comparison of the kind that can be made. In the first place, the prices mentioned for gas are not those now charged; and, such as they are, they take no account of reductions made for power gas, and gas supplied under large contracts. The figures quoted are the ordinary prices, and these are not correct to-day. It could not, however, be expected that an industry which has been in existence so long as that of gas supply, and which charges flat-rates for practically all purposes other than power, would be able to show the same percentage average reduction in recent years as electricity undertakings which make the lighting consumers pay heavily per unit, and then build up a big business in units for power and other purposes at extraordinarily low prices, until some of the undertakings have seen their average price diminish to such a fine point that they have had to cry a halt. If the "Financial Times" would ascertain what has been the percentage reduction in the average price charged for private electric lighting, and compare the figure with the percentage reduction in the average price charged for ordinary purposes for gas, it would be enlightened in probably (to it) an unexpected manner. Bearing in mind that the electric power business was small a decade ago, and that it has been built up on low prices which have not been to the advantage of the electric lighting consumers, who have had to bear the greater part of the burden of capital charges, the following sample reductions in price are quoted:

Municipal undertakings (ten years)—	
Islington	from 5·14d. to 2·21d.
Woolwich	from 4·69d. to 2·16d.
Fulham	from 4·89d. to 2·44d.
Southwark	from 4·08d. to 1·18d.
Hammersmith	from 3·68d. to 1·59d.
Companies' undertakings (nine years)—	
London	from 4·48d. to 1·99d.
South London	from 4·53d. to 2·28d.
County of London	from 4·54d. to 2·34d.

When the present average charges are examined, and when it is known how the power charges are a penny and under, and the relation that the volume of power business bears to the lighting business, then one appreciates how heavily the lighting consumers have to pay to make the average even what it is. The reduction of the gas charges between 1903-1913 is given as follows—the figures in parentheses being the current charges, some of which are subject to discounts:

Gaslight and Coke	from 35·29d. to 30·21d. (30d.)
South Metropolitan	from 27·60d. to 26·68d. (26d.)
Commercial	from 30·68d. to 29·92d. (28d.)
Brentford	from 37·28d. to 31·67d. (28d.)
South Suburban	from 31·76d. to 31·08d. (27d.)
Mitcham and Wimbledon	from 44·33d. to 33·84d. (29d.)
Wandsworth and Putney	from 30·45d. to 24·24d. (21d.)

Doubt at the L.G.B.

The Local Government Board are getting rather nervous over the question of the breakdowns of electricity supply; and it is very proper that they should, in view of the standing public danger that electricity supply is through its propensity to collapse, and that usually at times when failure is most severely felt. The District Council of Dartford have been before the Board, asking for a loan for the extension of the electricity supply plant, and a letter has since been received by them from the Board stating that, upon the evidence at the inquiry recently held with reference to the Council's proposals, it would appear that, in the event of a breakdown either in the steam-raising or the generating plant, there would be considerable difficulty in maintaining the present supply, as well as the bulk supply the Council are proposing to give to Crayford. The Board have therefore urged the Council to obtain the services of a highly qualified engineer to report as to the sufficiency of the stand-by plant in the event of a breakdown occurring. This the Council are going to do; but the incident shows that the Board (and it is about time) want to make as sure as electrical surety can be, that it shall not be an insufficiency of plant that allows failure of supply. On the other hand, an ample margin of plant for a small undertaking may mean a comparatively large capital expenditure.

Meaningless Fire Figures.

It is reported that, at the annual dinner of the Birmingham and District Electric Club, Alderman Shanks stated that, out of 823 fires in Birmingham last year, only 16 of them were caused by the fusing of electric wires, as compared with 53 produced by gas. If the totals for the past ten years were taken, the comparative figures were 91 fires through electrical faults, and 467 through gas. Perhaps Alderman Shanks will tell us what relation these figures bear to the total number of consumers—stated as fires per cent. of the total number. The money value of the destruction occasioned is also another good supplement to such bare and meaningless figures as Alderman Shanks supplies. There would be just as much sense in saying that, in a town where there were half-a-dozen motor omnibuses and 600 private motor cars, the former proved their greater safety by a smaller total of accidents than the latter.

Hydraulic Stoking Plant for Sheffield.

The Sheffield United Gaslight Company have recently placed with Sir William Arrol and Company, Limited, an order for a complete hydraulic stoking plant of the Arrol-Foulis charging and Hunter-Barnett pusher type, for their new retort-house at the Grimesthorpe works. In this case, Mr. J. W. Morrison, the Chief Engineer of the Company, has again made an advance on their latest plant of the same type at the Neepsend Works. The charge in each retort in this case will be as high as 18 cwt.; and no doubt is felt that the results will be entirely satisfactory. The one set of machines will deal with coal (and the coke therefrom) in producing 5½ million cubic feet of gas per day.

Note to Readers.—Owing to great pressure on our space caused mainly by the reports of proceedings before Parliamentary Committees, at the meeting of the Society of British Gas Industries, and at the Bradford Conference of the British Commercial Gas Association, it has unfortunately been necessary to hold over from the present issue much interesting matter. This includes, among other things: Mr. W. C. Clinton's paper, on "Comparison of Estimated and Observed Values of Illumination," read before the meeting of the Illuminating Engineering Society last Tuesday; Mr. W. A. Tookey's paper on "Practical Notes on the Running of Gas-Engines and Gas-Producers," at the meeting of the Junior Institution of Engineers; a portion of the Parliamentary Intelligence; and several Communicated Articles.

Illinois Gas Association.—The tenth annual congress of this Association was fixed to be held in Chicago last week. Among the papers on the programme were the following: "Street Lighting by Gas," by Mr. F. V. Westermaier; "Applications of Centrifugal Machinery for Boosting and Exhausting," by Mr. E. A. Hultz; "Modern Coal Gas Practice," by Mr. W. E. Hartman; and "Trenching Machines *v.* Hand Digging," by Mr. C. B. Strohn.

BRITISH COMMERCIAL GAS ASSOCIATION.

Manchester District Conference at Bradford.

THE Manchester District Conference of the British Commercial Gas Association was held last Tuesday, at the Bradford Town Hall. The proceedings commenced with the reception of members and visitors by the Lord Mayor of Bradford (Alderman John Arnold, J.P.), who, when he took his place in the chair in the Council Chamber, was supported by Mr. Councillor J. H. Barraclough (the Deputy-Chairman of the Bradford Corporation Gas Committee and the President of the Conference), Mr. Alderman Armitage, of Doncaster, Mr. A. Andrews, of Oldham, Mr. Alderman J. S. Phillips, J.P., of Salford, the Deputy-Chairman of the Manchester District Conference Committee, Mr. Alderman H. Wilde, the Mayor of Oldham, Mr. Robert Watson, of Doncaster, Mr. Charles Wood, of Bradford, and Mr. W. M. Mason, the Secretary of the Association. Many gentlemen signified their regret that they were unable to be present.

The LORD MAYOR said he was pleased to have the opportunity of giving a hearty welcome to the members of the Association, who were representing nearly all the important corporations and gas companies in that part of the country. Bradford, he could assure them, had always been one of the first towns in the path of progress; and he was glad that Bradford had been chosen for the first district conference of the Association in the North of England. Gas, as they would agree, was one of the necessities of life to most people; and the use of it had already done much to reduce the smoke evil in the large cities, as well as to lessen the work and worry of domestic life. He had found in his own home the advantages of the use of gas for heating, as (not having been well for some time) his gas-stove gave him great comfort. There was much more yet, however, to be done in regard to the expansion of the use of gas. It had given him very great pleasure to be able to welcome them.

Alderman ARMITAGE said the Association had not been long in existence, but it had shown signs of great vitality, enthusiasm, and executiveness. He was glad the Association was continuing its good work, and he could assure the Lord Mayor that the Association responded most heartily to the welcome which had been extended to it by him. All the members felt that they would get renewed vigour from the present meeting to do the work which was so necessary in Yorkshire even yet. He concluded by moving a vote of thanks to the Mayor.

Mr. ANDREWS seconded the resolution, and it was carried with acclamation.

The LORD MAYOR, having expressed his thanks, left the chair.

A WELCOME FROM THE BRADFORD GAS COMMITTEE.

Mr. Councillor BARRACLOUGH then delivered an address of welcome as President of the Conference. He had the greatest pleasure in welcoming the members in the name of the Gas Committee of Bradford and also on his own personal behalf. He attended the inaugural meetings in Manchester, and last year also he attended the meeting in London and the never-to-be-forgotten exhibition. The papers and discussions that he had heard he had followed with very great interest; and he felt that he owed the greatest part of his gas education to what he had got from these meetings and from the reading of the papers. Those present came to Bradford at a very opportune time in the history of the Gas Department—when they were in what was called a state of transition—and at a time when they wanted all the interest that they could have in the work of the Gas Department. He felt that the fact of their presence that day, and the influence of the lecture which they were to have that night, would much help them in regard to their relations with the public of the city. It was largely through the propaganda work of the Association that interest had been aroused in the development of the gas-works in Bradford; and whatever were the results in other centres of population, he was sure that the existence of the Association had been justified in Bradford. Not only the public of the city but the Gas Committee as well, had never been more eager, and had never more realized their position to further the cause of the citizens through the Gas Department, than was the case at the present time. He thought he could almost say that they had a unanimous Gas Committee in this respect. The Committee realized that the Gas Department was not there simply and merely to make large profits for the benefit of other departments, but that it had a much higher and nobler object and purpose in the life of the city. The consequence was that they had recently decided to modernize their plant very considerably; and the previous Tuesday, at a meeting of the Council, they got permission to instal new plant at a cost of nearly £120,000. He was glad to say that the resolution to incur this large expenditure went through the Council without a single word of comment and without a question being raised. This was no mean testimony to the confidence the Council had in Mr. Wood, their Gas Engineer. Of course, they could not have read all the papers with which the Association had supplied them in regard to show-rooms and so forth, without some desire to emulate what other cities and towns were doing throughout the country. He should be ashamed to take them to the present Bradford show-room, which was in a back street. They could not fairly designate it a show-room; it was more a stock-room. They had never really made any pretence of any show in the past; but a spirit of rivalry had now come over Bradford; and they now intended showing more, and getting more like what other cities and towns had become. They had taken the best shop in the best shopping centre in Bradford, and hoped before many months were over to have a show-room which would be fully worthy of the city. He must confess to being a gas optimist. He did not quite say that gas was the cure for all the ills that flesh was heir to; but he did assert that in the light of all the improvements which had been made in all departments of the industry, and particularly in research work (which was showing such interesting results), they could look forward with great hope and interest to the time when all citizens would be making the fullest use of their gas apparatus, with the result of brighter and cleaner homes, greatly reduced labour, better cooking for rich and poor alike, and the lifting of the cloud of smoke which was hanging so persistently over the industrial centres of the country. In regard to helping on this work, they all owed a deep debt of gratitude to the Association, and he sincerely wished it every success in the future.

MR. ALLEN'S ABSENCE.

The SECRETARY read letters of regret at inability to attend from a number of members—chief of whom was Mr. Edward Allen, the Chairman of the District Conference Committee, who found that he was obliged to be in attendance before a Parliamentary Committee in London in reference to the Bill of the Liverpool Gas Company, and who, therefore, offered his excuses for failing to deliver the address he had intended to deliver according to the programme of the proceedings.

The CHAIRMAN said they would all be very sorry to hear that Mr. Allen had found it impossible to be present. In the place of Mr. Allen, they had a worthy substitute in Mr. Alderman Phillips, of Salford.

AN ADDRESS BY MR. ALDERMAN PHILLIPS.

Alderman PHILLIPS said it gave him great pleasure to be present at this assembly; and he was sure he was expressing a general sentiment when he said that they owed a great deal to Councillor Barraclough and his Committee for the privileges which had been accorded to them. He was sorry that it fell to his lot to discharge the duty which should have fallen upon the President of the Institution of Gas Engineers and the Chairman of the District Conference, but the reason for the absence of Mr. Allen was one they must all accept. Whatever disqualifications he (Alderman Phillips) might have in endeavouring to replace Mr. Allen for the purpose of an address, he might at all events plead that he had taken a very keen interest in the establishment of the Association, and in its work from its inception up to the present moment. What, he asked, was the Association? It was an Association of all the representatives of gas undertakings and of the manufacturers of gas appliances who had found it was advisable that they should meet and confer and look upon one another from time to time in the common interest of the whole of them, and of the undertakings they represented. Speaking as Chairman of a Gas Committee who, for many years, were isolated in the sense that they all had their districts and areas in the ordinary pursuit of their duties, and had not the opportunity of meeting together, he had long felt that the difficulties and questions that arose from time to time were such as repeated themselves in many areas. It was therefore a pity that they should be left to themselves to deal with these matters, and to find the best way of removing the difficulties, when it was possible by mutual conference to do this much more easily. They lived in better days now. Formerly one might have lived to the age of a thousand years without making the acquaintance of those who were similarly engaged, as they were in that room, and from whom great benefit could be got by their being able to meet together and talk over the ideas and wants and prospects of the various undertakings. This they were now able to accomplish by means of the British Commercial Gas Association; and he hoped they would agree with him that everybody who was there that day would be very gladly welcomed into the Association. He said this because he took it that there were among them some who had not yet joined the Association. The members of the Association were very glad to welcome them, and hoped they would see their way eventually to come into the organization. The Association was only two years old; but it already represented something like 80 per cent. of the output of gas in the country. He was speaking of the output of gas, not of the number of undertakings. Their ideal went further than this; they wanted 100 per cent., and would not be satisfied until they had it. He could assure those present that it was no mere selfish plan which the Association was following. It was doing work which not one

of them, and no group of them, could accomplish single-handed. If they wanted to advertise in their various districts, it did not necessarily follow that the gas engineer, though he might have the best will in the world, was the best man in the world to draw up a taking advertisement. Advertisements cost money; and if they were not effective and continuous, they were waste of money. They must be of a high-class character, and continuous; and they must have put into them all the skill that they could get. It was for this reason that they cost a good deal of money. The Association had spent large sums of money already in this way, and all those who were present must have seen repeatedly, in some of the principal newspapers throughout the kingdom, the advertisements of the British Commercial Gas Association—most taking in their matter, well illustrated, and which had been very valuable factors in producing the wave of increased business which, he might fairly venture to say, had been experienced by every gas undertaking in the kingdom, whether it was included in the British Commercial Gas Association or not. The policy of the Association was not a selfish one. The Association had received a great many inquiries; and the Secretary, Mr. Mason, was constantly occupied in replying to inquiries from all over the kingdom. It had been his practice, when an inquiry had come from a certain district, to notify the gas undertaking of the district—whether its representative was a member of the Association or not—that such and such an inquiry had been received, and then each gas man was enabled to take up the matter from that point. The intention of the policy of the Association was, therefore, not merely to benefit its own members alone, but to spread the benefit over all the gas undertakings. He put this forward as the reason why all gas undertakings, whether large or small—though fortunately they had got in a great many of the larger ones already—who had not yet seen their way to come into the Association should do so as early as possible. The Association was still quite young; and he (Alderman Phillips) never knew a movement which had been so vigorous, and so active, and so productive of results as the British Commercial Gas Association had been during the short period of its life. For instance, during the last twelve months it had been providing literature, written by the most skilful hands that could be found, and illustrated by the most skilful pens that could be secured. These things had been produced wholesale; and the Association had sent out during the last twelve months no less than 2,600,000 copies, which had been sold to the various undertakings at wholesale price and at far less cost than any single individual in the Association could have got them for. This again was evidence that the purpose of the Association was not a selfish one, but was the purpose of benefiting the whole of the gas undertakings throughout the kingdom. And when they reflected that these undertakings represented a capital value of about £140,000,000, and employed about 100,000 men, and paid about £8,000,000 a year in wages, it would at once be seen that gas supply was not a fading industry but a growing one and held a very important place in the economic life of the country. It was evidently experiencing at this time, he was glad to say, a great deal of prosperity. One reason why a number of the smaller gas undertakings had not yet come into the Association had been that some difficulty had been anticipated, or some uncertainty had been felt, with regard to the attitude of the Local Government Board. These undertakings were subject to a Local Government auditor; and he wished to say to such of them as might have felt some doubt as to their ability to subscribe funds for the purpose of the Association, that means had been taken to test the position. If there was anybody present who did not happen to know of this action and its result, he might say that there was no longer any doubt or any difficulty with regard to their right to subscribe, and that no gas undertaking would run any risk of being surcharged by the Official Auditor for the reason that it had so subscribed. It had now been recognized that the Association was a proper thing to subscribe to; that it was one which would be beneficial to the industries themselves; and there was no further difficulty, therefore, in the way of their subscribing. The influence of the Association was not confined to our own land. It had members who had asked to be admitted from China, Japan, Australia, New Zealand, South America, United States, Africa, Canada, and, in fact, from all over the world, who were anxious to have the help of the Association and were anxious (in their own interests and for their own information) to benefit by the labours of the Association. These had been gladly welcomed to membership. The number of such members at present stood somewhere in the proximity of seventy, and was still growing. He had spoken about the advertising campaign which had been organized as being beyond the power of any one undertaking or any group of undertakings; and yet they were not satisfied with what had so far been accomplished. Although they represented 80 per cent. of the output of gas in the kingdom, they could, with very great advantage, go further and advertise more in the newspapers throughout the country, with good results to the undertakings in their various localities. And this was why they were anxious that their friends who had not yet joined them should come in as early as possible. Their friend, Mr. Goodenough, had been a prime-mover in the inauguration and carrying on of the work of the Association. The Association, and the gas undertakings of the whole country, owed a debt of gratitude to Mr. Goodenough for his unremitting labours on their behalf; and he believed Mr. Goodenough was stating an absolute fact when he made the observation, at the London meeting last October, that if the Association ceased to exist to-day there was no manager throughout the whole breadth of the kingdom who would not feel that his power for good had been decreased in his district. He (Alderman Phillips) believed that there was no exaggeration about this statement, but that it was a plain and reasonable statement of a fact which could not be gainsaid, as it was undoubted, from evidence which had been gathered from inquiries as to the operations of the Association in London, that the work of the Association had had a wide-spread and very beneficial influence. But the work was by no means done. Much as they had done already in the direction of making known the value of public and private lighting, and in combating the prejudice which existed in the past in regard to gas-fires and the increased demand for gas-fires up and down the country was evidence that they had done a great service for the people—there still remained, in regard to heating and cooking and the use of gas for industrial purposes, a wonderfully wide field yet to be covered. He thought one of the main features of the conference that they held in London was the paper read by Mr. Thornton, on the use of industrial gas. Only recently Mr. Thornton delivered a sort of supplement to the paper in Newcastle; and he (Alderman Phillips) was sure that the paper was going to do a great deal of good, and that the whole country was going to benefit from such papers as these. But they wanted to do even more. He might claim that the Gas Exhibition of last year would not have had the importance that it did have but for the efforts of the Association; and he did claim that the exhibition, as it was, was a wonderful success. It was a success if only from the one point of view that it was a co-operative exhibition, in which the individual manufacturers of apparatus allowed their personal interest to stand-down for the time being for the general benefit and success of the whole. This was a wonderful thing to do, and it spoke very well for the determination of those who were manufacturing appliances to help to bring the movement for the spread of the use of gas to its success. In spite of all these things, the Association had not yet done all they wanted. They also wanted an extended advertising campaign, as well as to find and appoint in connection with the Association one or more gentlemen who would be capable of carrying on research work, and who would from time to time be at the service of any district undertakings that had difficult questions to meet and could help them in the solution of these questions. This would be a very useful development of the Association's work. There was yet another thing. The Association had devoted very considerable time and effort to endeavour to elevate the quality and value of salesmanship; and he ventured to suggest that they were doing valuable work in raising the ideal of what the salesman ought to be, and what the salesman might be. Then there was the question of smoke abatement—a far-reaching matter, and one in which it was the duty of the gas undertakings to help by every means in their power. He ventured to say there was no section of the community which could do more than gas people to bring back the sunshine that Nature would give if only people would take the measures which were possible for them to-day, and were becoming increasingly popular throughout the country, as they were getting to be better understood—to bring back the sunshine which Nature would give in place of that constant pall of smoke which hung over the large towns of the country, and did so much to render the lives of the people callous, and poor, and unhealthy. There was a lot of work to be done there. Then in regard to the question of coke. The Association had taken up this matter also. He learnt the other day that there were people in this country who did not know what coke was, and had no idea what its use was, and who did not know that it was produced in gas-works. If this statement were true, there was a good deal of educational work to be done, and somebody must do it. The Association had already appointed a Coke Committee, who had been, and still were, considering what was the proper value of coke, what was the proper way to use it, and how it could be made most advantageous to the community. Without going into these questions any further, he thought he had said enough to show that the work of the Association had been for the general benefit of the whole community, as well as that of the gas undertakings throughout the land. He, in conclusion, cordially invited those present at the meeting whose undertakings had not yet come into the Association to weigh-up the circumstances and to decide that they would do so. He felt sure that they would not want to benefit by the work which the Association was doing without taking their fair share in the work; and he could only say that if they in the Manchester district would assist the Association to get to their ideal of having 100 per cent. of the undertakings and the output within the Association, they would be delighted to welcome them, and delighted to do everything they could to promote the work that they had in hand for the general benefit of the gas undertakings and the fulfilment of the ideal that they should do all they could to promote public health and welfare, comfort and economy. Although he did not wear the stripes of a recruiting sergeant, he was none the less a species of recruiting sergeant on this occasion. The objects and purposes of the remarks which he had made had been to lay before them, as well as he could, the purposes and function of the Association, and on its behalf to extend a very hearty invitation to all who had not yet joined it to become members.

Alderman H. WILDE moved a vote of thanks to Alderman Phillips for his able, interesting, and educative address. They all knew the interest he had taken in the work of the Association ever since he became a convert. Like himself, in the early stages

Alderman Phillips was somewhat sceptical; but they were both converted on the same day, and they could both now certainly see the great amount of good in the work the Association was doing, and was intended to do. Ever since the Association had fairly started, it had appeared to him that gas had been more particularly in the air than before. There had been a larger interest taken in the matter; and he thought the gas engineers and managers had bestirred themselves, as they were undoubtedly called upon to do, by force of the keener competition, and the Association had been a great factor in helping them in this respect. Alderman Phillips had been an inspiring personality in regard to the work of the Association, and had been one of the readiest in assisting to get the help of the outsiders. They, in Bradford, were fortunate in having a manager who had taken a deep interest in the Association, and whose work was certainly on model lines and "in the fashion" in regard to gas manufacture. He was pleased to compliment Mr. Wood upon having a Chairman who was not only interested himself, but was taking a very deep interest in gas affairs on behalf of the community of Bradford. In his own district (Oldham), they had had to do a little bit of proselytizing, in order to induce the Corporation to subscribe; but he was glad to say that in doing so they had certainly created greater interest in the question of gas and its distribution among the whole of the members of the Gas Committee and Town Council and, through them, the whole community. There had been a great advance made in Oldham in regard to their show-rooms; and they would be pleased to hear that the sales of gas in Oldham were up by over 100 million cubic feet, which was a very fine result, in one year, and was indeed remarkable in face of the great competition they met with from electricity. They were making very great advances in Oldham in the supply of gas alike for power and lighting and heat; and this was why they had gone up last year to the extent he had mentioned. He much appreciated the good work which the Association were doing, and felt that their thanks were due for this, and also more particularly to Alderman Phillips for the very able address he had given to them.

Mr. S. MEUNIER (Stockport), in seconding the resolution, said that the proposer had struck a right vein in regard to Alderman Phillips; and he trusted that the effect of the very able address which that gentleman had given, and which had named practically every point that was necessary, would be that any person who did not happen to be a subscriber at the moment would take home to his authorities the information that had been given to them, and induce his people to join the Association as quickly as possible.

The resolution was carried, and duly acknowledged by Alderman PHILLIPS.

At a later stage of the proceedings,

Mr. W. M. MASON (the Secretary of the Association) said at the opening conference of the Association, held at Plymouth the previous Friday, Mr. Goodenough took the opportunity of stating briefly some of the work the Association had done, and had asked him if he would follow on the same lines at the Bradford meeting. There were one or two simple points which might be helpful to those present who were chairmen and engineers of gas concerns. They would remember that something like £30,000 had been contributed, and that very large sums had been spent in advertising in papers that were to be got at the bookstalls anywhere; and this must have been influencing public opinion to a very marked extent. The Association advertised generally in the large society papers, and the national papers which went all over the world; also in the magazines which had a large circulation, and in some professional papers. The plan of advertising was to go in for what Mr. Goodenough called "blanket papers"—papers which circulated over a large area. They would understand that the Association did not attempt to do any purely local advertising, in merely local papers. This was left to the local company; and it had been proved time and again that the local gas department that advertised itself and pushed itself reaped most advantage also from the national advertising. The real value of this advertising could not be gauged by the number of inquiries. It was not at all a question of the actual number of inquiries that were received, but of the "atmosphere" which was created, which had a gradual effect. People were impressed by degrees; and the results came afterwards in a way which could not be tabulated. A very important part of their work, which was an accomplished fact, was that they were now able to provide means for helping local publicity. There was another point. Criticism had been made regarding some of the literature—some of the lighter "stuff" which had been specially prepared from the woman's point of view. He had discussed this matter with the Chairman again the other day. He had been a little dubious about some of it himself originally, and there were some gas managers and gas directors who thought that an advertisement was not an advertisement unless "gas was over every blessed thing yards thick." But he would venture to suggest to them that this was not the kind of literature that a woman ever read; and that was why some of this lighter literature had been prepared. Then there was another point in regard to which the Association had done good work; that was in the matter of defence. For the first few months after they were initiated one of his principal occupations was writing letters to the newspapers contradicting and hitting-back at people who were making misstatements against gas. This practice had gone down greatly now; and Mr. Goodenough had said at Plymouth that now their competitors knew that, "if an untruth put up its head there was a stick to hit it," there was not such readiness to give publicity to these untruths. Then there was the research work, which perhaps was not very well known, because they did not like to say too much about it. If they gave very detailed publicity to the whole of the work which was being done, their electricity friends would get an inkling, and they would be on the same track. But the work was being done all the same; and, further, there was the work of the professors in the lectures and articles which were reprinted, and all of which went to help on the gas industry.

Mr. ROBERT WATSON, of Doncaster, read a paper entitled "Municipal Authorities and their Customers." It appears on p. 825; and the discussion to which it gave rise is subsequently reported. At its close,

The CHAIRMAN moved the following resolution—"That this conference of representatives of gas undertakings in the Manchester district heartily approves of the aims, objects, and policy of the British Commercial Gas Association, and is of opinion that it should receive the whole-hearted support of every gas undertaking in the district, and appeals to the administrators of the non-subscribing undertakings to join in this national movement for the advancement of the gas industry throughout the British Isles." He said the resolution had his hearty sympathy. They, in Bradford, had found out the value of the Association, and had already got every penny of their money back. He believed the position they stood in to-day—of increasing sales and increasing plant—was largely due to the effect of the propaganda work of the Association. They all knew the difficulty of controlling such a mixed body of men as they got on a committee; but when once they could bring them all to one mind, and make them feel the same keen interest, satisfactory results were obtained. It was his firm belief that the propaganda work of the Association had largely done this in the case of the Bradford Gas Committee, the members of which had read the literature that the Association sent to them. He really did not know that he would have been there as Chairman that afternoon, if it had not been for the literature of the Association. He had been so imbued with the spirit of the Association, and it had put so much enthusiasm into him, that when his last election came on, and the gas question was rather prominent, he thought the best thing for him to do was to get up a lecture on gas, with lantern illustrations, and take it round his constituency. He had done so, and was surprised to find what a great demand there was for the lecture. He quite believed that his lantern lecture on gas had had a good deal to do with his having been sent back to the City Council at the head of the poll for his ward. He need say no more except to express his hope that the municipal authorities in the district who were not now members of the Association would make up their minds to come in, and let Alderman Phillips have the satisfaction of knowing that he had got his 100 per cent. of members.

Mr. Councillor WINTER (Stockport) in seconding the motion, pointed out that, although it was only two years since the Association was started, they had every reason to congratulate themselves upon what it had already accomplished. He hoped that, as a result of the conference that afternoon, there were a number of authorities who would enrol themselves as members.

The resolution was put and carried.

Mr. W. D. HELPS (Leeds) proposed a vote of thanks to the Chairman for presiding over the meeting—observing that he felt that Mr. Wood was greatly to be congratulated upon the confidence the ratepayers of Bradford had in his Chairman; and he felt equally sure that the Chairman knew the value of his Engineer. They had been interested to hear the way in which the Chairman had been returned at the head of the poll; and he (Mr. Helps) was quite certain that they would all hope that Mr. Barraclough might, for a long time, be the right-hand support of the Engineer in his dealings with the gas-works of Bradford.

Mr. HUBERT POOLEY (Leicester) seconded the resolution, and it was carried by acclamation.

The CHAIRMAN briefly thanked the meeting. He said that he had taken the position of Chairman that day with trepidation and fear; but he had the advantage of having intense interest in the work of the Gas Department, as he had had ever since he came into the Council some six years ago. The Gas Committee was the one committee where he felt in a congenial place among congenial people and doing congenial work. He had received the previous day from Mr. Mason an intimation that the General Committee of the Association had done him the honour of making him a Vice-Chairman, and he now wished to thank them for the honour which it would be his pleasure to take and to enjoy.

There was then an adjournment till 7.30, when the members (together with a large number of residents in Bradford and district) assembled in the Council Chamber to hear a lecture by Professor Vivian B. Lewes, F.I.C., F.C.S., &c., on "The Hygienic Value of Coal Gas as an Illuminant and a Fuel." The Professor's lecture was on the lines of the one he delivered at Plymouth the previous week, and the one he gave the day before at the Sanitary Institution meeting [see p. 818]. It was very enthusiastically received; and the experiments evoked hearty applause (as is usual with Professor Lewes's demonstrations). At its close Mr. Councillor Barraclough proposed, and Dr. Rabagliati seconded, a vote of thanks to the lecturer; and this was carried by acclamation. There was subsequently a reception to meet the Lord Mayor and Lady Mayoress and the Corporation of Bradford.

THE LATEST GAS UNDERTAKINGS' RETURNS.

Official Figures as to Gas Supply.

THE returns relating to the gas undertakings of the United Kingdom for the year ended Dec. 31, 1912, in the case of companies, and to March 31, 1913, for the local authorities, were issued last Thursday—having been ordered for printing on the 4th inst. The number of pages occupied is the same as before—103 for the gas companies, and 61 for the local authorities.

Information is furnished in reference to 826 undertakings, compared with 822 before. The new comers are the Bawtry and District, Bordon and District, Brodsworth and District, Welwyn, Knebworth, and District, Thurles, and Tipperary Gas Companies. Some companies drop out or appear under other headings. The new comers among the local authorities are the Bedwelty, Harrington, Hipperholme, and Margam Urban District Councils. The total capital authorized (including other purposes than gas supply in certain cases) is given as £161,253,541, of which £137,461,970 has been paid up and borrowed. For the local authorities, the capital authorized is £48,893,225, and the amount borrowed £43,681,976. In the case of the companies, the figures are: Amount authorized, £112,360,316, being £89,463,283 share and £22,897,033 loan capital; amount paid up and borrowed, £93,779,994. The receipts are: Companies, £22,358,030; local authorities, £11,910,340—a total of £34,268,370.

The statistics relating to working show that 16,052,487 tons of coal were carbonized; the quantity of gas produced being 215,492,714,000 cubic feet, of which 198,922,469,000 cubic feet were sold. The total make includes 27,141,026,000 cubic feet of water gas and 103,000 cubic feet of acetylene gas. The totals in the preceding returns were: Coal, 15,635,012 tons; gas made, 205,616,026,000 cubic feet; gas sold, 189,046,549,000 cubic feet; water gas made, 24,684,612,000 cubic feet; acetylene gas made, 97,000 cubic feet. At the date to which the latest returns were made up, there were 37,744 miles of mains in use for the supply of 6,876,149 consumers and 735,121 public lamps. The preceding figures were: Miles of mains, 36,393; gas consumers, 6,949,904; public lamps, 728,548.

Comparing the figures furnished by the present returns with those contained in similar returns for the previous nine years, it will be seen that the companies show as follows:—

Year.	Share and Premium Capital Paid Up.	Loan Capital Issued.	Receipts.	Expenditure.
1903. . .	£67,417,798	£13,451,381	£17,756,626	£13,214,322
1904. . .	68,953,306	13,775,734	17,828,872	13,397,727
1905. . .	70,605,726	14,176,599	17,617,598	13,410,307
1906. . .	72,008,451	14,467,842	18,166,087	13,671,369
1907. . .	73,152,891	14,645,271	19,567,336	14,884,982
1908. . .	74,328,645	14,944,060	20,013,159	15,475,933
1909. . .	74,952,664	15,168,298	19,951,779	15,097,658
1910. . .	76,797,028	15,396,163	20,446,438	15,308,928
1911. . .	77,382,751	15,606,929	21,134,770	15,903,361
1912. . .	77,963,589	15,816,405	22,358,030	17,231,015

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1903. . .	8,528,823	101,490,084,000	2,385,348	335,363
1904. . .	8,673,343	105,311,980,000	2,588,917	343,908
1905. . .	8,722,145	109,823,682,000	2,813,156	350,113
1906. . .	8,922,781	114,528,923,000	3,023,619	356,070
1907. . .	9,240,280	118,699,705,000	3,230,993	362,986
1908. . .	9,281,738	119,985,109,000	3,399,193	367,950
1909. . .	9,175,532	122,930,431,000	3,573,796	369,882
1910. . .	9,236,081	125,830,234,000	3,751,703	371,665
1911. . .	9,431,841	130,562,246,000	3,906,528	373,203
1912. . .	9,563,219	137,007,569,000*	4,062,289	373,793

* Including 21,114,934,000 cubic feet of water gas. Number of cubic feet sold, 126,001,893,000.

The somewhat similar figures for the local authorities are—

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1903-04 .	£37,103,279	£9,819,685	£7,182,008	£1,700,405	£967,194
1904-05 .	38,512,295	9,546,682	7,052,474	1,738,682	790,450
1905-06 .	39,401,896	9,636,107	7,085,710	1,799,094	798,210
1906-07 .	40,089,167	9,843,243	7,211,987	1,843,122	832,341
1907-08 .	40,712,159	10,500,416	7,839,122	1,882,427	827,454
1908-09 .	41,435,988	10,506,480	7,998,776	1,905,810	659,445
1909-10 .	42,002,322	10,398,263	7,710,985	1,970,241	767,961
1910-11 .	42,490,504	10,829,758	7,902,451	1,963,015	973,934
1911-12 .	43,108,248	11,184,000	8,161,944	1,990,756	1,045,057
1912-13 .	43,681,976	11,910,340	8,799,164	1,980,247	1,157,674

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1903-04. .	5,673,013	62,717,759,000	1,945,777	301,308
1904-05. .	5,622,259	63,335,696,000	2,148,260	310,275
1905-06. .	5,758,180	65,081,109,000	2,250,919	315,678
1906-07. .	5,923,476	67,312,153,000	2,339,914	321,910
1907-08. .	6,166,473	69,786,988,000	2,134,183	327,278
1908-09. .	6,112,569	69,933,629,000	2,516,927	332,746
1909-10. .	6,049,788	70,616,963,000	2,590,270	343,021
1910-11. .	6,161,702	72,903,220,000	2,666,146	349,120
1911-12. .	6,203,171	75,053,780,000	2,743,376	355,345
1912-13. .	6,489,268	78,485,145,000*	2,813,860	361,328

* Including 6,026,092,000 cubic feet of water gas and 103,000 cubic feet of acetylene gas. Number of cubic feet consumed, 72,920,576,000.

As usual, the returns contain particulars in regard to the proportion of water gas used, and also indicate the undertakings in which materials other than coal are employed in the manufacture of gas. The following is a list of the companies and local authorities making water gas; the figures in parentheses showing the maximum proportions (except where averages are stated) of its admixture with coal gas.

Companies.

Aldershot (not stated).
Alliance and Dublin (33).
Aylesbury (20).
Bath (50).
Bexhill (42·86).
Bilston (10).
Bishop's Stortford (42·88).
Bognor (30).
Bournemouth (42·7).
Brentford (40).
Bridgwater (20).
Bridlington (av. 33).
Brighton (46·78).
Bristol (42·05).
Cardiff (29).
Chelmsford (20).
Cleethorpes (12).
Colchester (33).
Commercial (56·18 during coal strike).
Croydon (48·7, average 28·05).
Dartford (32·2, one day only).
Dorking (25).
Durham (20 estimated).
Eastbourne (32).
Epsom (51).
Falmouth (20).
Faversham (1·19).
Felixstowe (14·7).
Folkestone (33).
Gas Light and Coke (*).
Gosport (44 in coal strike, average 8).
Gravesend (45 †).
Grays and Tilbury (30).
Guildford (20 to 25).
Hampton Court (51·2).
Harrow (47, average for one week).
Hartlepool (25, av. 16).
Hastings (52·68‡).
Hornsey (av. 34).
Horsham (25).
Hull—British (31).
Hythe and Sandgate (40).
Ilford (29·43).
Ilfracombe (22·5, aver. 10·2).
Ipswich (38·5).
King's Lynn (15).
Kingston-on-Thames (30).
Liverpool (50).
Lea Bridge (about 50).
Londonderry (15, av. 10).
Maidenhead (35).
Maidstone (20).
Malton (33).
Marlborough (30).
Merthyr Tydfil (about 30).
Mid Kent (35).
Mitcham (45·6).
Newcastle-upon-Tyne (22·88, one week).
Newport, Mon. (17).
N. Middlesex (49·25, av.).
Norwich—British (45·1).
Nuneaton (10).
Plymouth (44·18).
Pontypool (15).
Portsea Island (36).
Prescot (30).
Preston (34·5, av. for one week).
Ramsbottom (5).
Reading (46·9 one day).
Redhill (34).
Rhymney (15).
Ripley (20).
Rochester (48).
Romford (28).
Rushden and Higham Ferrers (15·08, av. 13·65).
St. Albans (30).
Scarborough (52·5, av. 30).
Southampton (38·5).
Southend (57·26).
Southgate (40·8).
South Shields (49·31, one day only in coal strike).
Staines & Egham (about 30).
Stretford (38).
Swansea (33·6).
Swindon United (46).
Taunton (33·33).
Tonbridge (25).
Torquay (42·2).
Tottenham (aver. 30·83).
Truro (50).
Tunbridge Wells (25 to 30).
Uxbridge (16).
Waltham Abbey (48, av. 7·2).
Wandsworth (48).
Watford (29).
Weston-super-Mare (30).
Wexford (25).
Winchester (33).
Wolverhampton (not stated).
York (34·77).

* Of the total quantity of gas sent out by the Company, 9 per cent. was unmixed with water gas. As regards the remainder, 57 per cent. contained a maximum proportion of 25 per cent. of carburetted water gas; 10 per cent., a maximum proportion of 31 per cent.; 8 per cent., a maximum proportion of 35 per cent.; 7 per cent., a maximum proportion of 37 per cent.; 8 per cent., a maximum proportion of 45 per cent.; and 10 per cent., a maximum proportion of 48 per cent. † Return is for year ended June 24, 1912. ‡ Average for the year, 29·31 per cent.

Local Authorities.

Aberdeen (25, year to July 31, 1912).
Accrington (25).
Ashford (51·6, av. 20·45).
Barrow-in-Furness (24·65).
Barry (2·25, subject to audit)
Belfast (not stated).
Birkenhead (63·85*).
Birmingham (25).
Blackburn (25†).
Burnley (40).
Carlisle (25).
Chorley (30).
Coventry (24·61).
Devizes (35).
Devonport (71·99*).
Dundee (25).
Edinburgh (15).
Halifax (28).
Hebden Bridge (20).
Leeds (27, one day only*)
Leicester (33·07, one day only‡).
Leigh (53*, normal 10).
Lincoln (33⅓§).
Longton (about 30).
Loughborough (20).
Manchester (19·44 on the total output).
Mansfield (20).
Middlesbro' (not stated)
Nelson (25).
New Mills (25).
Nottingham (10·17).
Oldbury (about 20).
Oldham (37‖).
Pontypridd (27·99).
Rochdale (15).
Smethwick (26).
Southport (67·53*, norm. 27·92).
Stafford (34·5).
Stockport (25).
Stockton-on-Tees (18).
Stourbridge (20).
Tipton (3·12).
Todmorden (20).
Torquay (29·4).
Tyldesley (67*, norm. 25).
Walsall (20‡)
West Bromwich (50·7).
Wigan (40*, normal 30).

* During the strike of coal miners. † Return is for year ended March 25, 1913. ‡ Return is for year ended Dec. 31, 1912. § In daytime; none at night. ‖ At one station only, on one day.

In the case of Ashford it is explained that the station meter was not working correctly; and that the quantity of coal gas given in the return (63,692,000 cubic feet) is probably too small.

Four new Companies appear in the lists—viz., Faversham, Pontypool, Ripley, and Waltham Abbey; but Barking, Bromley and Crays, and Chigwell drop out. Among the Local Authorities, Barry, Stourbridge, and Walsall appear.

The extent to which oil, petroleum spirit, carburine, or "other material" is being utilized for the production of gas, will be seen from the following list of the Companies and Local Authorities making returns.

Companies.

Aldershot.
Alliance and Dublin.
Alton.
Aylesbury.
Bath.
Bexhill.
Bilston.
Bishop's Stortford.
Bognor.
Bournemouth.
Brentford.
Bridgwater.
Bridlington.
Brighton and Hove.
Bristol.
Broadstairs.
Canterbury.
Cardiff.
Chapel Whaley.
Chelmsford.
Cleethorpes.
Colchester.
Commercial.
Corbridge.
Croydon.
Dartford.
Derby.
Dorking.
Dover.
Durham.
Eastbourne.
East Grinstead.
Epsom and Ewell.
Falmouth.
Fareham.
Faversham.
Felixstowe.
Ferndale.
Folkestone.
Gas Light and Coke.
Gosport.
Grantham.
Gravesend.
Grays and Tilbury.
Guildford.
Hampton Court.
Harrow and Stanmore
Hartlepool.
Hastings.
Hornsey.
Horsham.
Hull (British Co.).
Hythe and Sandgate.
Ilford.
Ilfracombe.
Ipswich.
Isle of Thanet.
King's Lynn.
Kingston-on-Thames.
Lampeter.
Lea Bridge.
Liverpool.
Londonderry.
Maidenhead.
Maidstone.
Malton.
Marlborough.
Merthyr Tydfil.
Mid Kent. [don.
Mitcham and Wimble-
Newcastle-upon-Tyne.
Newport (Mon.).
North Middlesex.
Norwich (British Co.).
Nuneaton.
Plymouth.
Pontypool.
Portsea Island.
Prescot.
Preston.
Ramsbottom.
Reading.
Redhill.
Rhymney & Aber Valleys.
Ripley.
Rochester.
Romford.
Rushden.
St. Albans.
Scarborough.
Sevenoaks.
Southampton.
Southend.
Southgate and District.
South Shields.
South Suburban.
Staines and Egham.
Stirling.
Stretford.
Swansea.
Swindon.
Taunton.
Tonbridge.
Torquay.
Tottenham.
Truro.
Tunbridge Wells.
Tynemouth.
Uxbridge.
Waltham Abbey.
Wandsworth and Putney.
Watford.
Weston-super-Mare.
Wexford.
Winchester.
Wolverhampton.
York.

Local Authorities.

Aberdeen.
Abergavenny.
Accrington.
Airdrie.
Alva.
Ashford.
Ballymena
Barrow-in-Furness.
Barry
Belfast.
Birkenhead.
Birmingham.
Blackburn.
Blackpool.
Burnley.
Carlisle.
Chorley.
Coventry.
Darwen.
Devizes
Devonport.
Dumfries.
Edinburgh and Leith.
Ellon (gas oil only).
Falkirk.
Glastonbury.
Greenock.
Halifax.
Hebden Bridge.
Helensburgh.
Heywood.
Kilmarnock.
Leeds.
Leek.
Leicester.
Leigh.
Lincoln.
Liverpool (Fazakerley).
Llandudno.
Longton.
Loughborough.
Manchester.
Mansfield.
Middlesbrough.
Mossley.
Nelson.
New Mills.
Nottingham.
Oldbury.
Oldham.
Paisley.
Perth.
Pontypridd.
Portsoy (acetylene gas).
Rochdale.
Smethwick.
Southport.
Stafford.
Stockport.
Stockton-on-Tees.
Tipton.
Torquay (St. Mary Ch.).
Tyldesley.
Walsall.
Warrington.
West Bromwich.
Wigan.

The new names in the preceding lists are the Chelmsford, Corbridge, Faversham, Grays and Tilbury, Pontypool, Ripley, Rushden, South Suburban, and Waltham Abbey Gas Companies, and the Ballymena and Barry Urban District Councils. The Barking, Boston, Bromley and Crays, Exeter, and Shrewsbury Companies, and the Alloa, Arbroath, Dundee, Kirkintilloch, Neath, Rhyl, and Todmorden Local Authorities drop out.

The Gas Commissioners of Portsoy used 10 tons of carbide of calcium in the manufacture of 103,000 cubic feet of acetylene gas, of which 75,000 cubic feet were employed for private and 27,000 cubic feet for public lighting—together 102,000 cubic feet, at the price of 4s. 9d. per 100 cubic feet. At the date to which the return was made (May 15 last) there were 70 consumers, about four miles of mains, and 72 public lamps.

TAR TREATMENT OF ROADS.

Revision of the Specifications.

THREE years ago, there were issued by the Road Board, for the use of surveyors and others engaged in the work of road construction and maintenance, some general directions and specifications relating to the tar treatment of roads. An indication of the contents of the pamphlet, with fairly full details of the specifications, was given in the "JOURNAL" for May 9, 1911 [p. 371]; and it will be recalled that there was subsequently some criticism of the conditions laid down in the specifications. This was, perhaps, more particularly in connection with the limitation of free carbon; the feeling being that the maximum proportion prescribed had been placed at a somewhat low figure.

A second edition of the directions and specifications has now been published; and there is no doubt that it will find its way into the hands of those concerned with road making and mending—the price being only 8d., or post free 9d., from Messrs. Waterlow and Sons, Limited, of London Wall, E.C. In many respects the specifications as first set out have not been altered; but there are variations which should be carefully noted. As before, the pamphlet consists of six sections—general directions for surface tarring on water-bound road, general directions for surfacing with tar macadam, general directions for surfacing with pitch-grouted macadam (single and double), specification for tar No. 1, specification for tar No. 2, and specification for pitch. It is, however, only as to the specifications for tar and pitch that notice need be taken here.

In specification for tar No. 1 (suitable for the surface tarring of roads), it is stated that the distillate between 170° and 270° C., or 338° and 518° Fahr. (middle oils), shall remain clear and free from solid matter (crystals of naphthalene, &c.) when maintained at a temperature of 30° C. for half-an-hour. It is, however, added that "this requirement may be waived in the case of tar supplied direct from gas-works; but tar from which the naphthalene has been extracted is preferable to tar containing much naphthalene." In the first edition, it was provided that "the free carbon shall not exceed 16 per cent. of the weight of the tar;" and the criticism was made in certain quarters that no directions were given as to the manner in which it was to be determined. The new specification contains the following clause: "The tar shall contain not less than 12 per cent. and not more than 21 per cent. by weight of free carbon. The free carbon is to be determined by complete extraction of the bituminous matter from a weighed portion of the tar by benzol and bisulphide of carbon. The residue left on treatment with these extractives is to be taken as 'free carbon.'"

Specification for tar No. 2 (suitable for making tar macadam, and for surface tarring in very hot weather, when the road crust is exceptionally dry) stipulates that the tar may contain not more than 25 per cent. of its volume of the tar (or distillates or pitch therefrom) produced in the manufacture of carburetted water gas. In the first edition, the figure was put at 10 per cent. The free carbon limit, which was before put at 18 per cent. of the weight of the tar, has now been altered to not less than 12 per cent. and not more than 22 per cent. by weight.

Prepared pitch from tar distilleries shall contain not less than 16 per cent., and not more than 28 per cent., by weight of free carbon; and commercial soft pitch, not less than 18 per cent., and not more than 31 per cent. In the latter case, the pitch may contain not more than 25 per cent. of pitch derived from tar produced in the manufacture of carburetted water gas—in place of the 10 per cent. given previously. The last-named alteration has also been made in the case of tar oils.

MOLESWORTH'S POCKET BOOK.*

THIS little book of engineering formulæ, now in its twenty-seventh edition, has deservedly earned a reputation for usefulness; but so far as the gas engineer is concerned, the facts and figures given remind one of the first edition of Newbigging's "Handbook." We are, for instance, told that "large or argand burners consume 6 to 10 cubic feet per hour," and that "pressure of gas to avoid leakage should seldom exceed 2½ inches of water." The bulk of the information is thoroughly out of date, and is such as might have been useful to our fathers had they died young.

The make per ton of Newcastle coal is given as 9500 to 10,000 cubic feet, the yield of tar as 70 to 90 lbs., and that of ammoniacal liquor as 80 to 120 lbs. The weight of tar corresponds to a quantity of 6 to 8 gallons, which, of course, is much too low; while the liquor might be anything, depending entirely on its strength.

We are told that "retorts are generally . . . 7½ to 9 feet long," and that their "capacity is 2½ to 3 cwt.," though it is not made clear to what duration of time the word "capacity" refers. Sandwiched between some of these obsolete data are a few figures referring to modern gas-retorts. But here again it is obvious that the paragraph referring to recent practice has been drafted by someone ignorant of gas-works; for, among other things, the fuel used is given as "coal." We meet with the sentence "wet purifiers require 1 bushel of lime mixed with 48 bushels of water for 10,000 cube feet of gas." Such matter as this is quite out of place in an up-to-date pocket-book.

Some figures referring to gas-works plant are given under the heading of "Rules for Gas-Works in Berlin." They are correct so far as they go. But why should it be necessary to refer to German practice in three short and very small pages on "gas-works" in a well-known English engineering pocket book?

An illustration of a very old direct-fired retort-setting is shown, together with a few figures relating thereto. We are told that with ordinary firing 2¾ to 3 cwt. of fuel is used per ton of coal carbonized, and with gas firing 4 to 5 cwt. The figures have, of course, been transposed. Later it is stated that "gas firing" increases the life of retorts by 66 per cent.; but coming after the above it gives a totally wrong impression of retort-house practice. In the same paragraph it is stated that "best heat varies with coal; 1600° to 2000° Fahr. cherry red for iron," and so on. This sort of stuff is worse than useless. We suggest that the information referring to gas-works should in the next edition be entirely re-written—and by someone who really understands modern gas engineering practice.

As regards the other matter contained in this pocket book, we have noticed in earlier editions that some of the formulæ have not been so clearly stated as might be desired, and also that two

* "Molesworth's Pocket-Book of Useful Formulæ and Memoranda." London: E. & F. N. Spon; 1914.

references to a particular subject do not in all cases agree. We are glad to notice that these defects have from time to time been eliminated; but there still remains room for improvement. For instance, on page 383 a table is given from which the horse power and width of belt at different speeds can be calculated; but it is not stated whether this table refers to leather or other makes of belting. On page 384, formulæ are given to calculate the dimensions of leather belting; but the results are very far from agreeing with the table on page 383.

Again, "Useful Memoranda for Hydraulic Calculations," on page 270, and "Useful Numbers for Rapid Approximation," on page 620, do not agree in detail—in fact, the information on page 270 might quite well be omitted. In many cases data on particular subjects are not grouped together, but are scattered throughout the book. This should surely be remedied. As instances, the strength of different types of belting is given on page 63; whereas it should obviously be included on either page 383 or page 384. The notes, too, on superheated steam (pages 439 and 441) should be transferred to page 522 and the following section, where the subject is treated at length. In fact, all the information on steam should be brought together. Some data also on steam-engine governors appear on page 490, and are continued on page 492; while the intervening page 491 relates to another subject.

We consider that under the heading "Compression of Air" or "Pneumatic Transmission" some information should be given respecting pneumatic plant for power purposes, which is now so extensively used. Further, on pages 495 and 496 particulars are tabulated regarding vertical engines and boilers, portable engines, Willan's engines, and horizontal tandem engines. This could advantageously be supplemented in future editions by particulars of modern high-speed enclosed types of engines. Connecting rod ends are dealt with on page 491; but the solitary example given is the old gib and cotter. A few examples of modern types would bring the information more up to date. We will not weary the reader with any more small defects, but would suggest that there is room for much improvement. The effect of such amendments would be to further increase the efficiency and utility of the book for rapid reference.

We do not wish by these criticisms to infer that this pocket book, universally known as "Molesworth," is anything but highly useful. On the contrary, we have always found that it fulfils its purpose admirably; but we do think that, so far as the gas-works section is concerned, a drastic revision is very necessary.

THE ELLWHITE GAS-STOVE.

In response to an invitation to witness a practical demonstration of cooking by gas with their new stove, the writer last week visited the show-rooms in Newman Street, W., of the Ellwhite Gas-Stove Company, Limited. The name itself, of course, does not in any way indicate the principles underlying the stove; but these are soon made clear in conversation with Mr. White, who is certainly enthusiastic on the subject of his invention. There are really several features embraced by the stove; the one first mentioned in the patent specification being that it can be used simultaneously for grilling, baking, and boiling purposes, without necessitating more than one burner or set of burners. At present (though this is not intended to complete the range) the stove is being made in three sizes, fitted respectively with four, six, and eight burners; and, as a matter of fact, at the time of the visit, a medium-sized one in use contained a joint of beef weighing over 8 lbs. and some cakes, while on top were vegetables in four saucepans. The burners being 3-feet ones, the consumption of gas was at the rate of 18 cubic feet per hour; and in reply to a question on leaving, Mr. White stated that the time taken to cook the meal would be two hours.

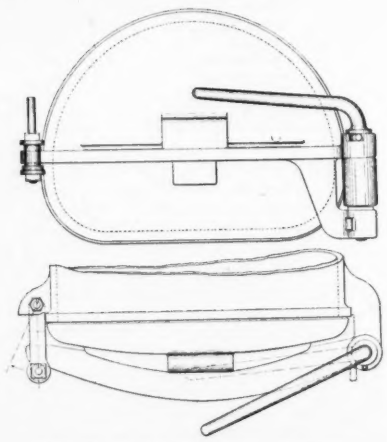
The oven is of the closed type, a principle which, as readers will be aware, has already been very successfully applied to gas-cookers—that is to say, no gas is burnt within the chamber in which the food is cooked. There are three compartments in the stove, the bottom of which is entirely closed. The lowest compartment contains the burners, the flames from which are concentrated on to a practically indestructible cast-iron plate, while at the same time sufficient heat passes through the bottom to heat the plates and dishes on a rack provided for the purpose. Above the cast-iron plate is the closed-in oven, the contents of which, it was pointed out, get the benefit of the heat without any possibility of contact with products of combustion. Outside air, too, is excluded from the oven, so that all the juices in the meat may be retained. After passing along the bottom of the oven, the hot gases travel up flues immediately outside the oven-walls, and are utilized in a separate chamber for browning, pastry, &c. On the top of the apparatus there are holes over which saucepans and similar utensils are placed; and finally the products of combustion pass away through a flue at the back, of such dimensions as to create the draught required to draw the fresh air into the stove. The only inlets for the air necessary to support combustion are a series of small holes down the sides of the stove; and the air drawn through these passes down a flue, the other side of which is heated by the gases passing upwards from the burners. Thus the air arrives at the burners in a heated as well as quite fresh condition. Convenient trays, grids, and so on, are provided, in order to divide the oven into sections as desired.

In the manner explained, one set of burners and one tap are made to perform the numerous duties referred to; and, in addition, in a narrow tank which may be fitted to the back of the cooker, it is stated that 2 gallons of water may be raised to boiling point, by means of the heat passing through the asbestos-lined metal. Of course, as there is only the one set of burners, it is impossible to partially utilize the cooker—for (say) boiling a kettle—without putting the whole thing into operation; but this little difficulty can be overcome by the simple expedient of having a boiling-ring fitted at the side of the apparatus. The stove is made of stout steel sheets—thicker, indeed, than are usually employed in work of this character; so that there is no fear of breakage, and it should last for years. The inside casing, or oven, itself may be easily renewed at any time desired. The stampings of which the cooker practically entirely consists are done at the Ellwhite Company's own works at Mount Pleasant, where complete machinery is installed for the manufacture of the stoves. In addition to the differences in sizes, variations in taste are provided for by making the cookers with and without legs.

From the brief inspection of it which it has been possible to make, the Ellwhite gas-stove appears to be an appliance deserving of consideration in connection with the purposes for which it is adapted. In the kitchen there is a practically inexhaustible field for the utilization of gas; so that there is plenty of room for new efficient apparatus. Thus there is an opportunity for this stove to occupy a sphere of usefulness of which it is sure to avail itself, if in work-a-day practice it is found to fulfil all that is claimed for it. Whatever may be urged as to the advantages, from the point of view of the meat, of cooking in a closed oven, it is doubtless upon considerations of economy that the stove will have to depend to make for itself a reputation.

HOLMAN'S NEW GAS-RETORT MOUNTING.

There are few names of makers of plant connected with the manufacture of coal gas which are so widely known as that of Mr. Stephen Holman. For the long period of sixty years he has, by his patents, rendered immense service to the gas industry; and this, it may be remembered, was recognized a few years ago by the presentation to him of a life-size portrait. Mr. Holman's first patent was taken out in 1854; in 1870 he produced his single eccentric hinged fastening for gas-retort lids, and four years later his double eccentric hinged fastening and bracketed cross-bar, which is in use in gas-works all over the world. He has now patented an improved arrangement which is shown in the accompanying illustration.



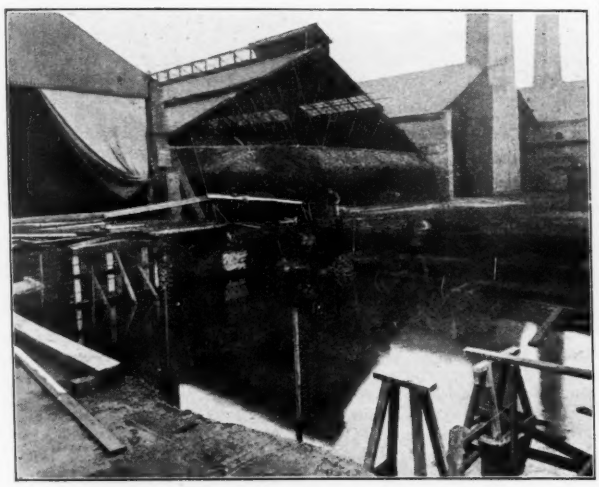
Holman's New Patent Retort-Mounting.

The new retort-mounting consists of a boltless self-sealing lid and screwless vertical and horizontal adjustments to compensate for the wear of the working parts after long use. The retort is opened and closed automatically by merely moving the lever 30 degrees of a circle to release and fasten the lid; thus greatly reducing the wear of the hinge, which carries the weight of the lid and cross-bar. All eccentric bolts are dispensed with, and all the adjustments are simple and easily accomplished without dismantling the lid or cross-bar. The new mounting, which is made by Messrs. Westwoods and Wrights, of Brierley Hill, is in use in one of the retort-houses at the Beckton station of the Gas Light and Coke Company (the Governor of which, Sir Corbet Woodall, D.Sc., has been able to follow the course of the Morton self-sealing lid from the time Mr. Holman's firm commenced its manufacture till now); and we are informed that it will shortly be adopted at the Tottenham and other gas-works.

The subject of "Illumination in Connection with the Textile Industries" will be dealt with by Mr. Leon Gaster, the Hon. Secretary of the Illuminating Engineering Society, at the meeting of the London Section of the Society of Dyers and Colourists to be held at Dyers' Hall, Dowgate Hill, Upper Thames Street, E.C., on Thursday evening.

CONTINUOUS VERTICALS AND TELPHER COKE PLANT AT LEICESTER.

Over the scene at the Belgrave Gate works of the Leicester Corporation Gas Department, there has come a great change, and the change will be continued for some period hence, according to the plans of the Engineer (Mr. Hubert Pooley, Assoc.M.Inst.C.E.). Those who remember this station as it previously existed will call to mind a works congested and hemmed-in by property on all sides; and yet it is a works that has not by any means given a bad account of itself, under the care of the Superintendent, Mr. William Smith. The congestion has to an extent been relieved by what has been done since Mr. Pooley's official advent in Leicester; but when plans are eventually consummated, the site will again be full, though the modernization and improvements will have given not only a doubled productive power, but better freedom and circulation about the place.



Flood in the Excavation for the Foundations.

Preliminary Work.

In order to obtain as much additional land as possible—and it was not a great deal that could be obtained—for the purpose of the modernization scheme, it was necessary to scrap eight cottages. There was also purchased an additional acre of land on which may be placed a gasholder. And later boundary walls will be constructed close up to the public roads. The old road into the works has hitherto been much congested with traffic; but as the scheme develops, there will be two roads—one in and one out—with an island office between; so that the incoming and outgoing traffic will not cause obstruction the one to the other.

In the alterations necessitated by the scheme, an old gasholder of a capacity of some 250,000 cubic feet has had to be scrapped; and its site has supplied a good coke ground, which to-day is commanded by a fine telpher plant, which has only just been completed. Four small scrubbers are also marked for demolition.

The Old Plant and the Space Economy of the New.

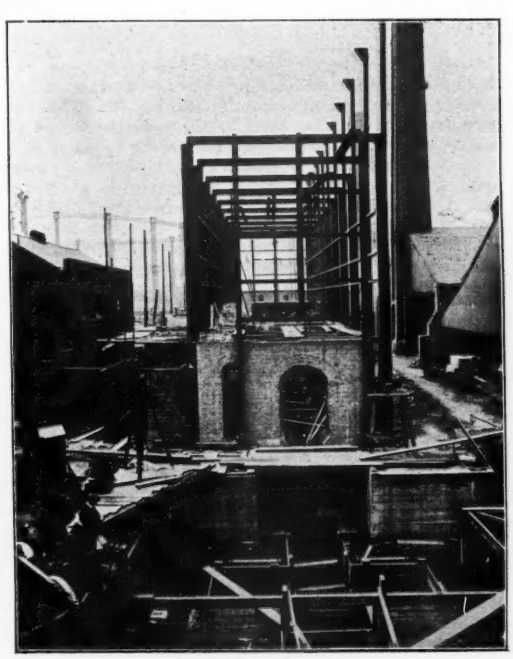
For the accommodation, too, of the new vertical retort-house and its auxiliary plant, the half of four buildings—retort-houses and coal-stores—has been removed. They have been severed crosswise; and the day is not far distant when the remainder of these buildings will have produced their last foot of gas. Let it be said, in passing, that they have done good service; and the horizontal retort-beds that are still standing are giving a fine account of themselves. They are generator settings. Before the changes commenced, there were in the three houses 43 beds, containing a total of 301 retorts of 20 feet length; and now there are still standing until further extensions on the vertical system are made, 37 beds containing in all 259 retorts. We looked at the heats of these old generator settings. They were excellent; and Mr. Smith and his men take a pride in securing from them high results. The make of gas per ton of coal—mainly Derbyshire and about 20 per cent. of South Yorkshire coal—would do credit to some of the more modern systems. Scoop charging is the method here; and 12,200 cubic feet of gas per ton of coal is the average make. As to the fuel account——well, the records of the last half year show that it did not, in these generator settings, exceed 12½ lbs. per 100 lbs. of coal carbonized. But old systems have to give way to the economies of the new; and one of the very essential economies at the Belgrave station was that of space. In former days, the maximum possible production on this site was 2½ million cubic feet; but when the reconstruction is completed—when vertical retorts are the sole method of carbonizing on the works—on the same ground space 5 million cubic feet per day will be produced, or an exact doubling of the production. The vertical installation so far completed is alone capable of producing 2½ million cubic feet per day. This increased production per given area is an important consideration in works economics, where space is a consideration, as the capital expense of a new site and works can in this way be postponed for a considerable period.

Men's Accommodation.

When passing to the new vertical retort-house, we just take a peep into the men's mess room and lavatories; this being the first piece of reconstruction that Mr. Pooley took in hand at this station. The bath-rooms and lavatories are really nice places, and excellently equipped; and what is more, of the washing accommodation the men make good use, which is the best evidence of appreciation. The walls of the bath-rooms and lavatories are faced with glazed tiles, which give the place a very clean appearance. Of the baths, the attendant informed the writer that most of the men make constant use. Hot water is supplied by means of a coke-boiler (placed outside the building), which does not consume more than 7 cwt. of coke per week. The secret of the cheapness of the hot-water supply is noticed in one corner of one of the rooms where is seen a cylindrical hot-water tank of some 200 gallons capacity. Good tank capacity means cheapness. The mess room above is equipped with every requirement for the men's meals and comfort, including lockers. This is a little digression; but the point interests anyone who has a sympathetic leaning towards those who perform the actual duties of gas-making from day to day.

The Glover-West Vertical Retort Installation.

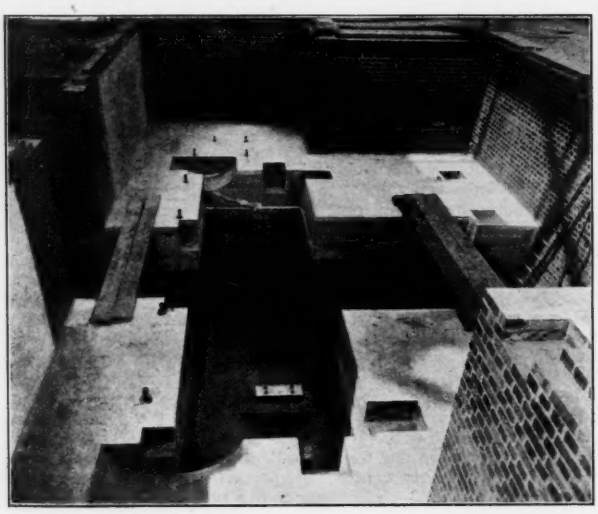
The new retort-house next engages attention. From Mr. Pooley, it was learned during the inspection that the foundations under the whole house and settings consist of a monolith of concrete, carried to a depth of 8 feet. The house itself is a steel-framed structure of the type that West's Gas Improvement Company, Limited, adopt for vertical retort installations; the panels being throughout filled in with 4½-inch red brickwork. Light and ventilation are well provided for; in fact, in the building of the upper panels the form of the ventilating apertures presents quite a picturesque appearance—picturesque to the point of being from an outside view, striking when the house is illuminated at night-time from inside. The dimensions of the house are 135 feet long, 47 feet wide, and 70 feet to the apex of the roof, which is slate-covered. A point that is observed is the total absence of waste space. From all the work, proceeding from the top of the retorts and ending with the discharge and removal of the spent (and be it observed practically moisture free) coke, there is no need for anything more round the benches than the galleries and stairways for obtaining access to every part of the retort installation above the ground floor to the coal hoppers and conveyors in the roof, and to facilitate inspection of the combustion chambers. The plentiful provision of galleries and stairways of this kind is, for convenience and safety, very much to be preferred to any arrangement of ladders.



End View, Showing the Coal-Crusher Pit.

As to the retort plant, the present installation conforms to the standard practice on the Glover-West system. But, briefly described, there are ten settings, each containing eight tapered retorts, making a total of eighty retorts, arranged in four parallel lines, each setting being divided into two sections of four retorts. The retorts are heated by the Glover-West system, in which (as those who know, or have studied, the features of vertical retort

systems are aware) the secondary air supply is heated by the resultant coke at the base of the retorts, so that the coke is discharged in a cool state—the heat being thus recovered for use in the settings. The combustion chambers are arranged in separate tiers, and are independently regulated—the whole of the waste gases eventually passing around the top ends of the retorts before making their exit to the chimneys, of which there is one to each setting. A gas-producer is provided for each setting of eight retorts; and this is fed from coke-waggons running along a rail-track well above the line of producers. The producer charging-waggons receive their load of coke from a hopper-store outside, and at one end of the retort-house. On all parts of the galleries it is noticeable that there is no uncomfortable temperature for



Coal-Crusher Pit.

the men—the hottest point being in immediate proximity to the chimney of each setting. Another observed feature was this: The collecting-main into which each set of eight retorts discharge has a fall back, to allow of inspection; and should there be any accumulation of thick tar in the main, it can be readily removed through the tar-pipe provided for the purpose, or through a self-sealing lid, also provided for cases of emergency. In passing round, the excellent character of the work is noticed. Everything is beautifully finished off; and there is no detail missing in the plant requisite to the facilitating of work and the realization of high results. The faced joints of the lids of which inspection has just been made is one evidence of this. The sight-holes, again, have covers to which one has only to give a quarter-circle turn to make an examination. Little things tell in a big plant.

The Coal-Handling Plant.

In dealing with the coal-handling plant, we must go outside the building again to the end where the coal-breakers are situated, and where during the putting in of the foundations some of the most ticklish work had to be carried out, owing to water (a canal runs quite close), and the proximity of a tall chimney, weighing about 4000 tons. The foundations of the chimney are 14 feet deep; and it was necessary to go 13 feet below them; so that the total excavation was about 27 feet deep. The foundation work was executed (under the Engineer) by the Gas Department's own men; all the rest of the work above the foundations constituting the contract of West's Gas Improvement Company. The coal-breaker pit is built of wire-cut blue brindle bricks. The coal-receiving hoppers, breakers, and all else are duplicated in every respect. From the breaker-hopper, the coal drops on to jig-screens—the small being bye-passed down to the elevator boot; the large passing on to the breaker. Each breaker, which is capable of dealing with 50 tons of coal per hour, is provided with mechanical feeding gear, and has two pairs of claw rolls suitable for breaking the coal to the size required for the system. From the breakers, the coal is elevated by a gravity-bucket conveyor, which extends the whole length of the retort-bench, and is provided with dumping gear and shoots to the coal-hoppers above the retorts. Of these hoppers there are twenty, each having a capacity of 15 tons of coal, equal to 36 hours' requirements of four retorts. The outlets, corresponding to the number of retorts, supply the coal-feed hoppers on the Glover-West principle of continuous carbonization.

A Handy Lift.

In one corner of the retort-house a lift is noticed. Its chief employment is for raising the coke required for filling the retorts when they are started up to work, after scurfing; and it is further available for raising coal in the event of the ordinary coal plant being temporarily out of action.

Electrically-Driven Plant.

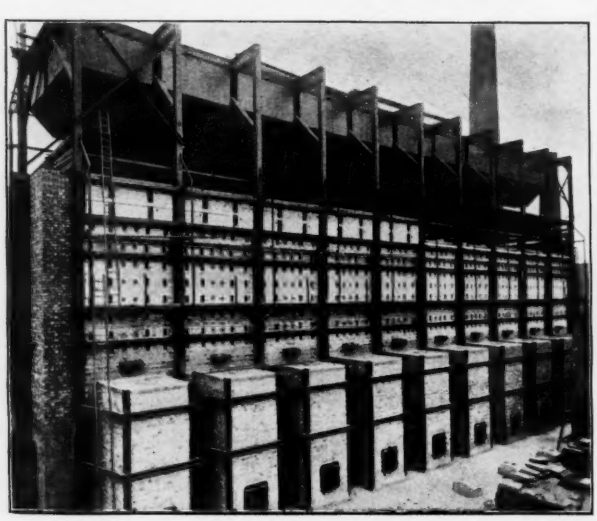
It is convenient to mention here that the whole of the plant—the coal and coke handling and screening plants (the coke plant will be presently described), the retort coke extractors, as well as the lift—is electrically operated by current obtained from the Corporation Electricity Department's cables (the supply being 500 volts, continuous current). The whole of the starting switches are fixed at one point in the retort-house, and near the ground-floor. At one end of the main building is the motor-house from which the extractor gear is driven. The first thing noticed in this house is that the main by which the hot gas travels from the retort-house has been brought through it. The electrical equipment (like all the other plant) comes under the contract of West's Gas Improvement Company. It is noticed that the two motors in this house were made by Electromotors Limited, of Manchester; that they are totally enclosed and dust-proof; and that the pressure of the supply is 500 volts, 13·8 amperes. The switch gear and instruments are by Messrs. Bertram Thomas and Co. The retort-house lift is also electrically driven by a motor, supplied by Electromotors Limited, standing on a concrete bed close to the lift.

Governors.

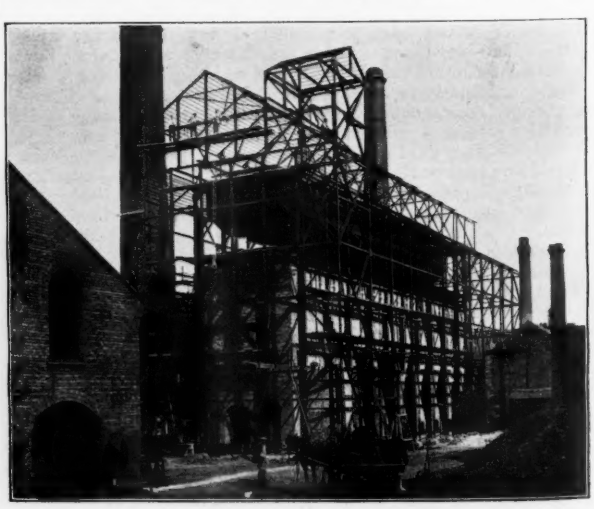
Included in the equipment supplied under West's Improvement Company's contract is a pair of Parkinson and Cowan's retort-house governors.

Manufacturing Results.

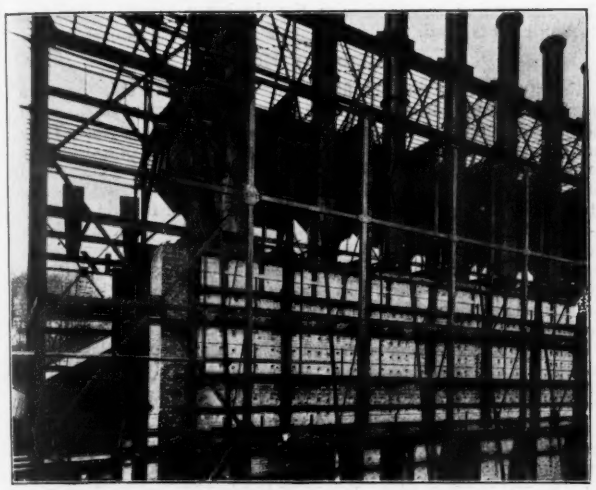
As to the results from the Glover-West settings, Mr. Pooley prefers not to speak at present. But this much may be said: It has already been mentioned that excellent results have been, and are being, obtained with the old horizontal generator settings and scoop charging, using about 20 per cent. of South Yorkshire coal, and the remainder Derbyshire. With these old settings the make averages about 12,200 cubic feet of 14·5 candle gas. But with the Glover-West settings, the make has been so much more than this that Mr. Pooley intends to wait, before permitting any publication, for the results of a long run, after the settings have settled down into normal working. However, it may be remarked that at the time of the visit to the new plant, with five settings in operation, 1¼ million cubic feet of gas per day were being made. The coke is infinitely better than under the horizontal system of working; and there is not such a large quantity of small from it. It is also perfectly dry, owing to the heat extraction treatment to which it is subjected before finally leaving the settings. As a matter of



Side View, Showing the Producer-Gas Furnaces, &c.



Steel Frame of the Building and Hoist.



Producer Side of the Retorts, Showing the Flues, Chimneys, and Hoppers.

fact, the difference in a load is as between 18 cwt. to 19 cwt. and 24 cwt. to 25 cwt. with moisture-weighted coke. As people have experience of the coke from the verticals, they prefer it; and it is found simply excellent for household purposes.

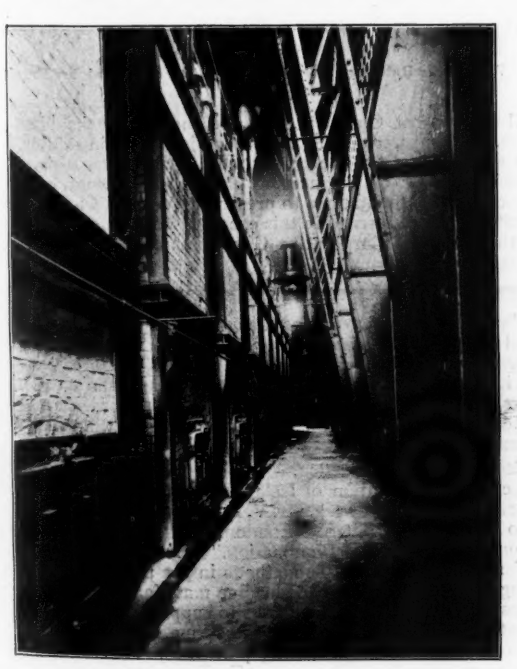
The coke-handling plant has yet to be described; but it may be said that when the telpher is at work, and with a production of 1½ million cubic feet of gas a day, the number of men required will be: Two in charge of the retorts per shift, one telpher man, one fireman, and one man (for fifty-four hours per week) on the coal plant—making thirteen men per day. With the whole plant running, making 2½ millions a day, nineteen men will be required.

The Telpher Coke-Handling Plant.

Vertical retort installations particularly lend themselves to prompt coke handling by the telpher system; and especially with the type of retort plant in use here, as the coke can be handled without any delay in quenching immediately on its exit from the retorts. The telpher coke plant was also included in the contract of the West Gas Improvement Company; but, for them, the plant was manufactured and erected by Messrs. Robert Dempster and Sons, Limited. In view of the facility with which the coke can be dealt with by means of the plant, it may be of interest to describe the installation at Leicester in detail.

Removal of the Coke from the Retorts.

The coke from the retorts is discharged into hoppers or skips, which are conveyed along the ground-floor on independent carriages running on rails placed at right angles to the side of the retort-house. The loaded skips (each of which has a capacity equal to the discharge at one time from four retorts) are brought into position directly under the portion of the telpher track which runs parallel, and adjacent to, the side of the retort-house. The telpher then hoists the skips, and conveys them to the feeder hopper for the jig-screen over the storage hoppers, or to the hopper for the retort-producer, or deposits the coke in the storage yard. The time taken by a telpher to do one cycle—that is, hoist the loaded skip from the bogie, travel to the extreme end of the coke-yard, discharge the coke, travel back and lower the empty skip on to the bogie, is only four-and-a-half minutes—a speed that it is unnecessary to try to excel.



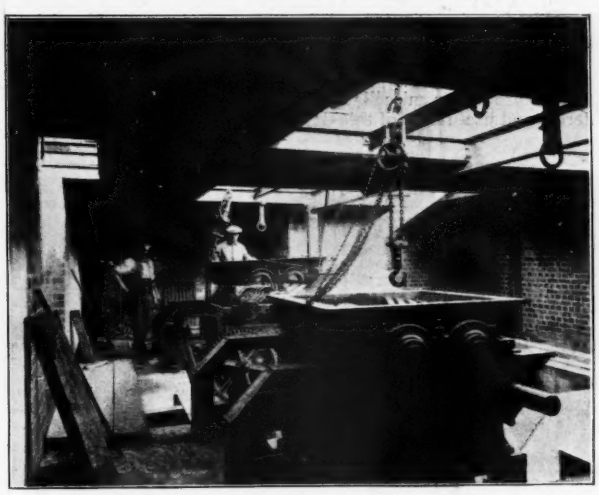
Producer Gas-Furnaces.

A Neat Flooring.

In passing we notice that the ground-level floor and out below the telpher track by the side of the house is of concrete, and this is faced with a mat-like surface, to prevent slippiness. We were interested in seeing how this surface was obtained. It is an importation from Scotland by Mr. Pooley; and it is secured merely by the use of a small hand-roller; the roller being of brass, and so cut that, when run over the surface of freshly-laid concrete, the mat surface is the result. The change from a smooth surface is quickly made. It looks well, and is useful in promoting safety.

The Telpher Track.

Now for a description of the telpher track, which has a fine sweep, and is on the up-to-date monorail principle. It consists of 15 inch by 5 inch track-joist, with a stiffening channel bolted on top to give horizontal stability. The actual bulb running-rail is bolted on top of the channel by hook bolts; so that the track-rail is easily renewable when worn. The track is supported at intervals of not exceeding 25 feet by substantial steel channel and plate hangers; the hangers being carried from overhead lattice girders, of the Warren type. The lattice girders are made, in most cases, of 75 feet span; but, in some instances, the span has been reduced,



Coal Crushers.

for convenience in the coke-storage yard. They are carried on the top of trestles; each leg of the trestle being constructed of two 6-inch by 3-inch channels, substantially lattice-braced together by 2-inch by $\frac{5}{16}$-inch flat bracing, and jointed together at the tops by two 12-inch by 3½-inch channels, on which the ends of the Warren girders are supported. Each trestle leg (with its steel-angle horizontal and diagonal bracing) is provided with a substantial plate and angle base, and is securely held to concrete foundations by means of 1¼-inch diameter holding-down bolts. The Warren girders are constructed of steel channel bottom booms and steel angle-top booms; the booms being fitted diagonally with steel-angle bracing. The whole of the structure has been designed with a minimum factor of safety of 5 to 1 throughout when stressed with the maximum possible loads.

Regarding the electrical part of the work, two lines of overhead trolley wires (positive and negative) are fitted to the underside of the top cross-joists of the trestles, and are carried off special steel-angle brackets on the hangers of the lattice girders. The wire is figure 8 section, and is clipped by gun-metal ears, carried from bell-type insulators. At each of the track switches, overhead wiring switches are provided; each being operated by means of a small lever. As already mentioned in dealing with the retort-house, the electricity supply (500 volts direct current) is provided by the Corporation Electricity Department.

The Electric Telphers.

There are two complete electric telphers, Brooks and Dempster's patent swivel-bogie design. Each machine is suitable, it is understood, for hoisting a gross load of 40 cwt. at 70 feet per minute, and travelling at a speed of 500 feet per minute. The machines consist of a rigid steel frame, which carries the hoisting gear, driver's cabin, &c. The steel frame is mounted on swivel-bogie trucks; each swivel-bogie being provided with a pair of manganese steel travelling wheels—the wheels being mounted on steel spindles revolving in Hyatt roller-bearings. The side of one of the bogies is fitted with an L-shaped steel casting, which projects under the telpher track. From this the travelling motor is suspended, and fitted with a chain pinion, which is connected to

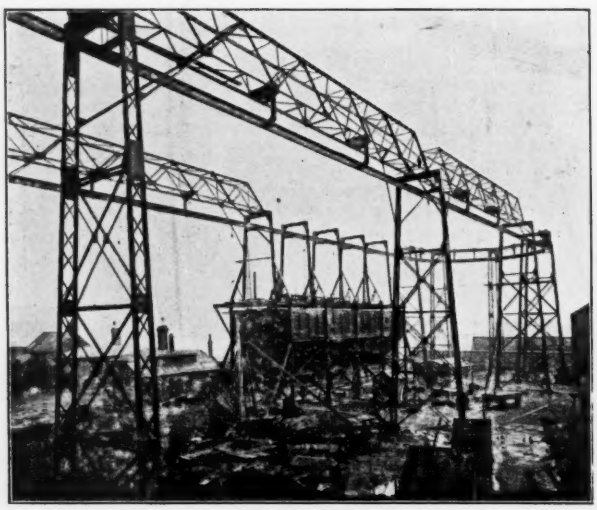
two chain wheels by Renold silent-link chain; the chain-wheels being keyed to the end of the same spindles on which the travelling wheels are mounted. Thus the whole of the travelling bogie, the motor, and the chain-drive swivel together. Both bogies are so arranged that the rigid frame is pivoted on the top; the bogies themselves being free to turn on the centre, so as to allow of the machines travelling easily round the curves. The bogies are also arranged to rock laterally, which ensures the travelling-wheels always being in close contact with the track and taking a proportion of the weight of the machine—thus obviating any tendency to skid when running in wet weather.

The Hoisting Gear.

Concerning the hoisting gear, it consists of a Siemens motor, driving the main hoisting shaft through a set of reduction gear. An automatic brake is fixed to the motor armature spindle, to hold the load should the electric current ever fail or when the current is shut off. A substantial band brake is also fitted to the main hoisting shaft, which is controlled by hand from the operator's cabin. The steel pinion driving the main hoisting shaft is arranged to slide out of gear operated by a lever from the cabin. Thus the operator can lower the load under gravity without rotating the motor or the gearing—the lowering being controlled by the band brake. The hoisting-drums are provided with machined grooves to suit the hoisting ropes; there being two ropes per machine, each 70 feet long. The operator's cabin is fitted to the underside of the main frame, and contains the levers for the hoisting brake, sliding pinion, travelling brake, main-switch, fuse-boxes, and controller. This single controller is so connected to operate either the hoisting or travelling motor by a change-over switch. A four-light bulkhead fitting is arranged on the front of the cabin for night work; and a one-light bulkhead is provided inside the operator's cabin.

Miscellaneous Features.

There are a few miscellaneous points which may add to the interest and usefulness of this description. In the first place, the cabin is constructed of timber panels, and fitted with windows all round to ensure an unobstructed view in any direction. It is also fitted with a sliding-door, so that the operator is entirely protected from the weather.



The Telpher Track completed and the Coke-Store.

Each telpher is provided with two collector trolleys; the head of each being fitted with a small wheel, which is kept tight up to the overhead trolley wires by means of tension springs. The trolleys are also mounted on swivel bases, to allow them to swivel when the machines are running on the curved portion of the track. A tipping cord is provided on each telpher, so arranged that it is wound up by means of counterweights when the skip is hoisting, and is automatically paid-out when lowering; the cord passing through the cabin, so that the operator can, by pulling the cord, release the tipping-catch on the skip, and thus tip at any height desired.

The coke-skips (to which reference was made earlier) have each a capacity of 15 cwt., and are constructed of steel plate and angles. They are provided with a trunnion at each end, to which the hooks of the lifting-bale are attached; the trunnions being fixed in such a position that, when the tipping-catch is lifted by the operator, the skip automatically turns through one complete revolution, thereby discharging the load, and automatically righting itself. The tipping-catch is provided with a balance-weight, which ensures it being in a position to hold the skip in its righted position after tipping.

Each machine is provided with a lifting-bale-constructed of two horizontal channels, each 5 inches by 2½ inches. To these channels the ends of the hoisting ropes are attached. At each end of the channels a round bar hook is fixed—the hook nearest the cabin being provided with the tipping catch to which the tipping-cord is fixed.

Coke-Storage Hoppers.

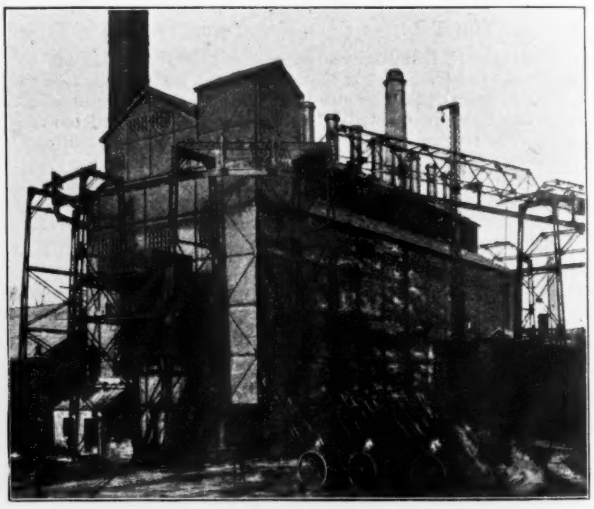
For storing coke and for filling carts, a range of coke-hoppers has been installed in a convenient position in the coke-yard. The hoppers are 68 ft. long, 22 ft. wide, and 17 ft. 6 in. deep. They are constructed of steel angles and plates, and are supported by means of steel-channel stanchions; each stanchion being composed of two 10-inch by 3½-inch steel channels, and provided with strong steel-angle and plate-bases, secured to concrete foundations by 1-inch diameter holding-down bolts. The lower portions of the hoppers are coned, and fitted with slide-doors, with operating gear. On top of the hoppers, a balanced jigging-screen is provided for sizing the coke, and delivering the different sizes into the various sections of the hopper. The screen is fed by a small hopper (into which the telphers dump the coke) situated at one end of the screen. It is provided with a shoot for regulating the feed to the conveyor.

Coke-Hopper for Producers.

In the description of the retort-house, it was mentioned that, at one end of the house, a hopper for storing coke for the producers had been provided. This is carried from two of the telpher trestles, and is supplied with coke by the telpher. The hopper is cone-shaped at the bottom, and is provided with a swing-door for feeding the producer bogies, which are run out from the retort-house to the hopper on a gantry; the gantry being on the same level as the producer-charging stage.

A Good Fit and Congratulations.

Throughout the work—retort-house installation and coke-handling plant—everything appears from inspection to be of the highest order. It says something for the planning and execution of the work that—though the foundations (which were very complicated pieces of work), were put in by the Corporation Gas Department, and the retort-house work was carried out by West's Gas Improvement Company, and for them the coke plant by Messrs. R. Dempster and Sons—everything fitted in exactly. It is not surprising. Mr. Pooley, we know from former experience, is particular over his engineering planning and work, and the contractors have reputations to preserve. We can with freedom congratulate all concerned in this excellent work, and at the same time the Leicester Corporation Gas Committee upon their new possessions.



End View of the Building, Showing Completion of the Telpher Track.

Manchester District Junior Gas Association.—The fifteenth annual meeting of the Association will take place on Saturday, the 4th prox., at the Exchange Hotel, Manchester. After the presentation of the report and balance-sheet, and the election of officers, Mr. J. M'Nicholl, of Warrington, will deliver his Presidential Address. High tea and a smoking concert will follow the business proceedings.

Economic Light Production.—At a meeting of the Engineering and Scientific Association of Ireland, held in the Royal College of Science, Dublin, last week, Mr. Val. H. Mackinney, Chief Engineer to Holophane, Limited, of London, lectured on "Light and the Economic Production of Illumination." He made out a strong case for the need of scientific methods in the production of good lighting, and remarked that the leading manufacturers of lighting fixtures and glassware were anxious to supply lighting data to all interested in the matter. At the same time, he gave a number of figures to show that good lighting paid the public. The lecture was illustrated by limelight views, affording examples of good and bad lighting.

A NEW TYPE OF CARBONIZING CHAMBER FOR GAS-WORKS,

THE KOPPERS COMBINATION OVEN.

By G. Stanley Cooper, F.C.S., &c.

In a previous article, the writer referred to an installation of combination ovens at the Koenigsberg Gas-Works, Germany; and as this installation has now been set to work, a detailed description of the plant will no doubt prove of interest.

The Koppers combination oven was developed from the horizontal chamber oven which has been adopted at many Continental gas-works and also at Birmingham. It will be remembered that the ordinary type of chamber oven is heated by means of gas made in a central producer plant. The combination oven, on the other hand, is arranged so that it can be operated at will either as a gas-oven or as a coke-oven. In the former case, it is heated by producer gas; and in the latter case by a portion of the gas evolved from the coal. Consequently, assuming that 50 per cent. of the gas produced is required for heating the oven, it will be seen that the gas production can vary by 50 per cent. without interfering with the supply of coke. At the same time, the plant is very flexible indeed, owing to the fact that the change from a gas-oven to a coke-oven, and *vice versâ*, can be made almost instantaneously.

With most systems of carbonization, in order to make any substantial alteration in the output, it is necessary to work new settings of retorts during times of heavy demand, or else to shut-down settings when the demand increases. With the Koppers combination oven, this difficulty is avoided. Ordinarily, the ovens may be heated with producer gas, and thus allow the whole of the gas from the coal to be available for sale. If the demand for gas falls off, the poorer portion of it may be used in place of producer gas for heating the ovens. The coal gas may be substituted for the producer gas in any proportion. The volume of the gas used is proportional to its heating value; and hence one method of operating is just as efficient and economical as the other. An installation of thirty-five Koppers combination ovens has been at work for several months at Joliet, Illinois, U.S.A., operated by the Coal Products Manufacturing Company. This plant has a daily capacity of approximately 450 tons of foundry coke, and 3,550,000 cubic feet of illuminating gas, together with the customary quantities of tar and ammonium sulphate. The gas is used for illuminating purposes without any enrichment whatever, and is delivered under pressure to a number of towns in the vicinity of Joliet.

The Construction of the Koppers Combination Ovens.

In order to explain the construction and working of this type of oven, it is desirable to compare it with the Koppers regenerative coke-oven and the horizontal gas-oven respectively; and for this purpose drawings showing cross sections through these ovens are reproduced.

In the coke-oven, only the air for combustion is preheated in the regenerators—cold gas being used. This gas is part of that evolved from the coal being carbonized; and approximately 50 per cent. of the gas evolved is required for the purpose of heating the ovens. The gas evolved from the coal is first denuded of its bye-products, and then the requisite amount is returned to the ovens. For each oven wall, a distributing pipe, G, supplies the gas to each individual vertical heating flue in one half of the oven wall. Air for combustion enters through the regenerators, R; passes into the vertical flues; and, on meeting the gas there, combustion takes place. The hot products of combustion then pass away through the top horizontal flue, down the vertical flues in the other half of the oven wall, and through the second regenerator to the chimney. In passing through the regenerator, the chequer brickwork becomes heated up. Every half-hour the direction of combustion is reversed; the hot regenerator being used to heat the incoming air.

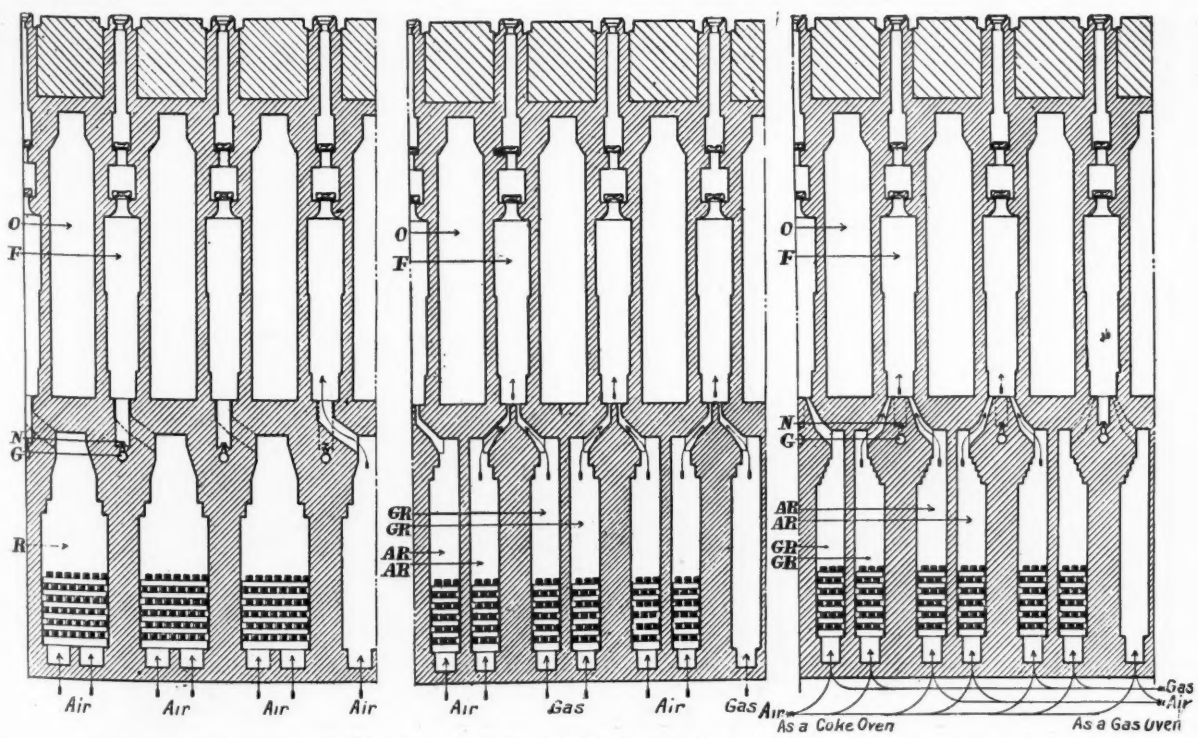
In the gas-oven the same principles of operation hold good; but the ovens being preheated by producer gas, it is necessary, in order to obtain the most satisfactory results, to preheat both air and producer gas. This producer gas is manufactured in a plant of the Kerpely or Mond type, and is then led to the ovens. A divided regenerator is used in order to equalize the flow of producer gas and air in two directions, and also to enable more efficient regulation of the heating. Alternate regenerators are used for air; the intermediate ones for gas. The air is preheated by passing through the regenerators A R., and the gas by passing through the regenerators G R. As in the case of the coke-oven, the gas and air meet in the vertical flues, and combustion takes place. From this point, the operation of the oven, reversal of direction of combustion, &c., are carried out in exactly the same manner as is described for the coke-oven.

The combination oven is so arranged that it can be operated either as a coke-oven and be heated by a portion of the coal gas, or as a gas-oven and be heated by producer gas. Consequently, it is necessary in this oven to provide divided regenerators, so that both gas and air can be preheated, and also a distribution pipe, G, for conveying coal gas to the heating flues direct.

If the oven is to be worked as a coke-oven, all the regenerators are used to preheat the air. The coke-oven gas, freed from its bye-products, enters the distributing flue G, and the oven works in exactly the same manner as that described above for the working of the coke-oven.

If the oven is worked as a gas-oven, one pair of regenerators is used for preheating the air, and the next pair for preheating the producer or blast-furnace gas. The heated gas and air meet in the vertical flues F, and combustion takes place—the oven now working in exactly the same manner as described above for the working of the coke-oven.

The temperature of the oven can be maintained just as easily



A.—Koppers Cross Regenerative Coke-Oven.

B.—Koppers Cross Regenerative Coke-Oven.

C.—Koppers Cross Regenerative Combination Oven.

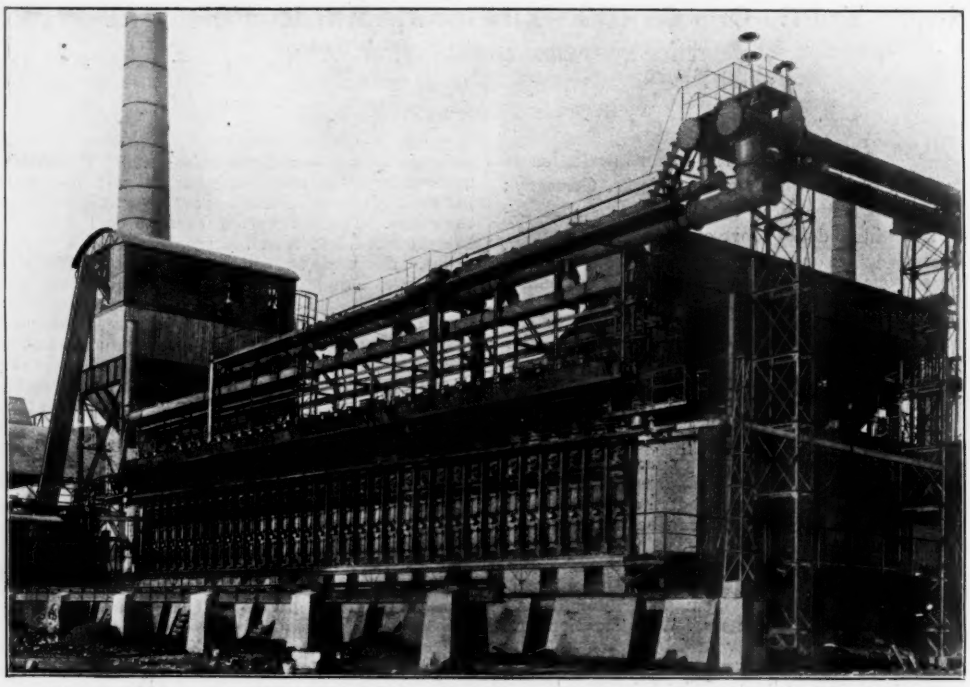


FIG. 1.—GENERAL VIEW OF THE KOENIGSBERG OVENS FROM THE PUSHING-ENGINE SIDE.

in one case as in the other; and the change from a gas-oven to a coke-oven, and *vice-versâ*, can be made almost instantaneously and without interfering with the working of the ovens in any way.

Recovery of Benzol.

Much has lately been written with regard to the recovery of benzol from town gas. It is interesting to note that this is quite feasible on a large plant using the Koppers combination oven when it is operated as a coke-oven. As already pointed out, in this case about 50 per cent. of the coal gas is required for heating the ovens; and the benzol can be recovered from this in the usual way by scrubbing the gas with creosote oil.

The Koenigsberg Installation.

At Koenigsberg a battery of thirty-five Koppers combination ovens has been in operation for some little time, and is giving complete satisfaction. In order to accommodate the supply to the demand, when the output required is small, as in summer, the plant is to be operated as a coke-oven, and in winter when the demand for gas is large, it will be operated as a gas-oven. Kerpely rotating grate producers are provided for the purpose of generating the producer gas required; and as these can be put into operation from cold in a very short time, it will readily be seen that the output of gas can be doubled in a few hours—instead of in a few weeks, as is required in most systems of retorts. The illustrations reproduced herewith show various views of the Koenigsberg plant.

The ovens have a capacity of about 10 tons of coal each; and this is carbonized for a period of twenty-four hours. The coal is fed into the ovens by means of a charging waggon which runs on top of the setting. This waggon receives its coal from a storage hopper into its four compartments; and from these the coal is dropped through four corresponding charging holes in the roof of the oven. A machine which runs alongside the battery then levels the coal in the oven; and the whole chamber is closed, and the ascension-pipe valve opened. The doors are of the self-sealing type, and are water-cooled. While the ovens are being charged, the doors are, of course, closed; and when the charge is carbonized, they are lifted out of position by an attachment to the quencher and coke-pushing machine respectively. By means of this latter machine, the charge of coke is pushed out of the oven through a quenching hood into the quenching machine that is shown in fig. 2.

Recovery of Tar and Ammonia.

At Koenigsberg the whole of the gas produced is to be treated by the Koppers direct process for the recovery of the tar and ammonia. A brief description of this process will no doubt be of interest in view of the probability of the more general adoption of processes of this kind on gas-works. The hot gas from the ovens passes, *viâ* the ascension pipes, into a dry collecting main, and thence through water-tube coolers, thereby condensing the moisture and most of the tar. The remaining traces of tar are removed by passing the gas through a "P. & A." extractor. The

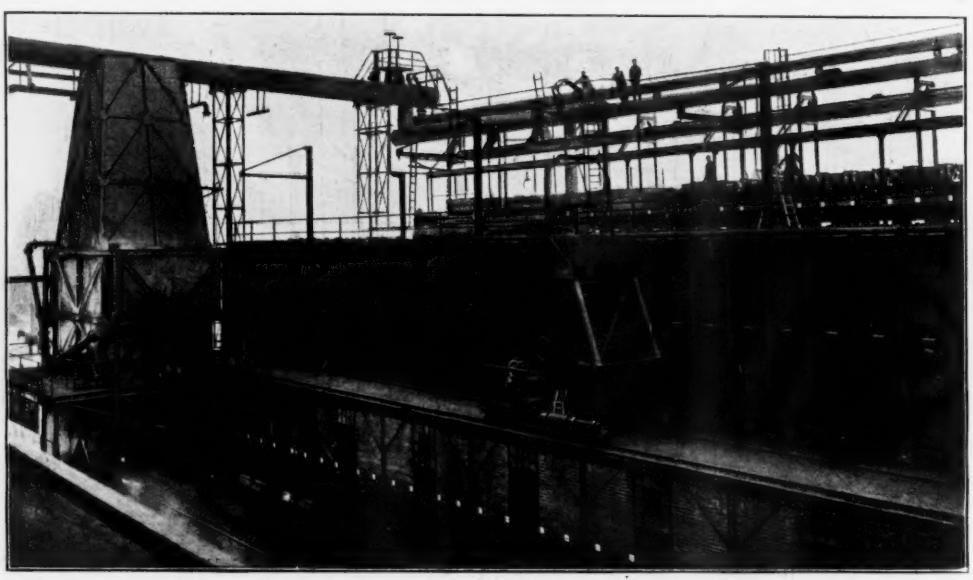


FIG. 2.—GENERAL VIEW OF THE KOENIGSBERG OVENS, SHOWING THE QUENCHING SIDE.

FIG. 3.—TOP OF THE OVENS, SHOWING THE CHARGING CAR IN POSITION UNDER THE COAL-HOPPER.

gas is then reheated by means of exhaust steam to a temperature of about 60° to 70° C., and then passed into the saturator containing sulphuric acid, where the whole of the ammonia that it contains is absorbed.

The ammoniacal liquor produced is distilled as usual, with steam and lime; and the ammonia, joining the main gas stream, is also recovered in the saturator. It may at first sight seem that it is rather a roundabout way to first cool the gas and then reheat it; but this is done for several reasons. In the first place, it is far more easy to extract the whole of the tar at a low temperature than at a high one. Moreover, if the coal used contained much chlorine, ammonium chloride would be produced; and if this were not removed from the gas, trouble would be experienced owing to the decomposition of this body in the saturator, and the consequent production of hydrochloric acid gas, which would have disastrous effects on the metal work of the plant.

It has also been pointed out that, if the gas is not cooled, it carries with it in suspension a large quantity of water vapour. On passing through the saturator, the gas would give up some of this water, and so dilute the bath as to make the formation of solid sulphate difficult if not impossible. Koppers recognized this difficulty. He therefore arranged first to cool the gas and then reheat it; so that, instead of the gas depositing moisture in the saturator, it actually carries away moisture from the saturator—thereby assisting the formation of sulphate. The cooling process also helps materially to lessen naphthalene troubles. At a temperature of 25° C. the naphthalene content at saturation is about 1·7 grammes per 100 cubic feet, while at a temperature of 50° C. it is over 14 grammes per 100 cubic feet. So that the advantages of cooling as far as this trouble is concerned are very great.

Effect on Illuminating Power.

The Koppers process is in operation at several gas-works and coke-oven plants supplying gas for town use; and it has been found quite suitable for the purpose. It has been suggested that one result of passing the gas through the saturator will be to decrease the illuminating power of the gas. This is, of course, totally without foundation; and when it is pointed out that the saturator really contains only 5 per cent. of free acid in the mother liquor, it will be seen that there is little ground for the objection.

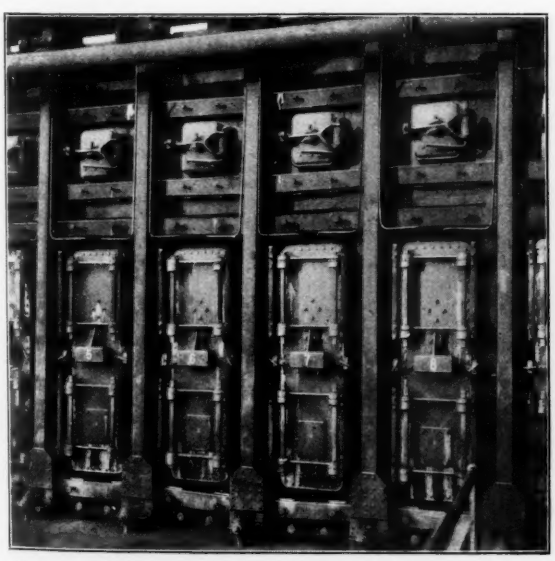


Fig. 4.—Construction of Oven-Doors; also Levelling-Hole Door.

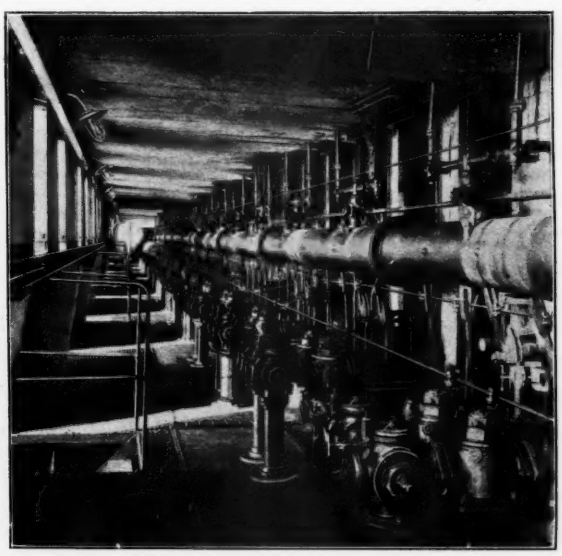


Fig. 5.—Arrangement of Gas and Air Regulation Fittings.

Gill's Furnace Clinkering Machine.—At the close of the article referring to this appliance which appeared in last Tuesday's "JOURNAL," the statement was made that the machine is being put upon the market by the Woodall-Duckham Vertical Retort and Oven Construction Company, Limited. We now learn, however, that the sole licensees are Messrs. Duckham and Cloudsley, Ltd

Informal Meeting of Scottish Gas Managers.—The annual informal meeting of Scottish Gas Managers will, the Convener (Mr. J. W. Napier) announces, be held in the Grand Hotel, Charing Cross, Glasgow, on Wednesday, the 1st prox., when the President, Mr. William Wilson, of Falkirk, will deliver an address. Dinner will be served at the close of the meeting.

WORKS TOPICS—XXV.

By "Modus Operandi."

The Flushing of Hydraulic Mains.

Quite recently two well-known gas engineers, Messrs. J. G. Newbigging and Thomas Glover, have, in their presidential addresses, alluded to points connected with ammonia, which is my excuse for introducing this subject in these notes.

Mr. Newbigging was discussing the question of hydraulic main liquor and the relative effect of using ordinary ammoniacal liquor and clean water for supplying the hydraulic mains. The points he raised are very interesting; but I am by no means convinced that it is necessary to use fresh water to avoid the difficulty he mentions—*i.e.*, throwing off from the liquor used in the hydraulic mains the bulk of the CO_2, SH_2, and NH_3 already extracted by the liquor in the washers and scrubbers. Granted that it is necessary to run considerable quantities of liquor into the hydraulic mains, it is, as he stated, a mistake to use for this purpose liquor which has done much useful purification work in the washing and scrubbing plant. This liquor is saturated with the acid gases, CO_2 and SH_2, which have combined with NH_3 in various forms. If properly circulated, such liquor will have absorbed as much of these impurities as it can carry, and should be of a strength approximating to 20 oz. The only proper place for such liquor is the sulphate plant; and if it is to remain concentrated at its existing strength, it must neither be agitated overmuch nor must it be heated above the temperature of the atmosphere; otherwise it will readily lose ammonia and the CO_2 and SH_2 in combination therewith. This liquor, therefore, must not, under any pretext, be used for supplying the retort-house.

The Properties of Hydraulic Main Liquor.

Sufficient liquor—and liquor that is practically free from CO_2 and SH_2—is made in the retort-house to do all that is necessary in connection with supplying and flushing hydraulic mains. The reason that this liquor is free from CO_2 and SH_2 is, of course, that it has condensed from the gas at too high a temperature to retain these gases, which pass off readily from ammoniacal liquor at a temperature exceeding 100° Fahr. Ammonia, on the other hand, though very volatile, has an exceedingly strong affinity for water, and is consequently retained by the liquor to a greater extent at least than the gases CO_2 and SH_2, and remains in a free and uncombined state (so far as combination with CO_2 and SH_2 are concerned) with the liquor. The ammonia thus present in the liquor combines to form ammonium chloride, sulphocyanide, and thiosulphate, all of which constitute, of course, what is known as "fixed" ammonia. If, therefore, the liquor that is made in the retort-house is circulated therein by means of suitably placed tanks and a pump (no other liquor being used) it will soon absorb a lot of ammonia, nearly all of which will be in the fixed state. But it will not throw off any CO_2 or SH_2, as very little of these impurities will be extracted, owing to the high temperature. Liquor used in this way will become concentrated to well over 12-oz. strength, of which from 80 to 90 per cent. will be "fixed" ammonia.

It is probable that quite 50 per cent. of the total quantity of liquor is condensed in the retort-house; so that there will be a considerable surplus of liquor which will overflow from the retort-house tanks into the storage well. Incidentally this liquor, if properly circulated through the hydraulic mains, will be of at least 12-oz. strength.

Working in this way none of the disadvantages mentioned by Mr. Newbigging should be experienced. When flushing with this liquor, no additional quantities of CO_2, SH_2, and NH_3 should be found present in the gas. On the contrary, I have ascertained that with this method in use, the variation from hour to hour of these impurities in the gas is certainly no greater, whether flushing or not, than in Mr. Newbigging's case, when using a water-feed to the hydraulic mains.

Suggested Method of Working.

I would therefore suggest that all the liquor made in the retort-house should be caused to flow into a special tank, from which it should be pumped into a supply tank situated at a higher level, and in a suitable position for supplying and flushing the hydraulic mains. By this means only the surplus made leaves the retort-house. To my mind it is disadvantageous to introduce into the liquor more fresh water than is absolutely necessary. It merely dilutes the liquor, which, when removed to the sulphate plant, requires more steam than would otherwise be necessary. Fresh water must, of course, be used for extracting the last traces of ammonia; but its use should be limited to this part of the plant.

A further advantage of the system described is that the liquor in circulation in the retort-house is very hot; but as it is re-circulated again and again it has no effect on the temperature of the liquor in the main storage tank, except so far as the surplus is concerned. If, on the other hand, this liquor were circulated from the main storage tank, the liquor in stock would soon become very hot, owing to its being used for cooling the gas, with obvious disadvantages.

Circulation of Liquor in Tower Scrubbers.

Mr. Glover's remarks on the capacity of tower scrubbers are very much to the point. So far as I know, there are no published data giving the required flow of liquor per square foot of scrubber area. In scores of cases tower scrubbers are in use with a totally insufficient supply of liquor to properly cover the whole area of the surface. In my own experience, the efficiency of some tower scrubbers was enormously increased by doubling the capacity of the pumps in use. In spite of this improvement, I am convinced that their efficiency could again be substantially increased by augmenting still further the amount of liquor in circulation. If any reader can supply figures of interest in this connection, it would, I am sure, prove very useful to engineers who are anxious to increase the capacity of their scrubbers and simultaneously increase the strength of their liquor. Perhaps Mr. Glover would be kind enough to enlarge on his remarks on this particular question, as many would doubtless like to profit by his experience.

The Use of Fresh Water in Tower Scrubbers.

The idea of dividing the final scrubber into two compartments, the top of which is used for clean water and the lower for weak liquor, is quite a good one. Without this arrangement, the fresh water added merely dilutes the weak liquor in circulation in the final scrubber, and is therefore not used to the best advantage. The fresh water, to be really effective for removing the last few grains of ammonia, should be used without admixture with liquor; but in the ordinary tower scrubber this is impossible. With Mr. Glover's arrangement, on the other hand, this is done on the proper lines with obvious advantages. It is more than probable that by this means a gallon of fresh water is twice as effective as with the usual arrangement. It is possible, however, that even better results would be obtained were the diameter of the scrubber decreased in the top portion that is devoted to the circulation of the fresh water; as, assuming that 10 gallons of clean water are used per ton of coal carbonized per diem, and assuming also that 100 tons of coal are in use, the daily quantity of water is only 1000 gallons, the proper distribution of which on a large area would be impossible when divided over so long a period as twenty-four hours.

ASSOCIATION OF ENGINEERS-IN-CHARGE.

If the attendance continues to grow as it has been doing, even the big King's Hall, at the Holborn Restaurant, will soon be unequal to requirements in the way of accommodation for the annual dinner of the Association of Engineers-in-Charge. Those who sat down on Saturday evening to the nineteenth of these enjoyable functions numbered considerably over three hundred; and there could have been no one present who would not wish to repeat the experience. The President (Mr. R. J. Glazebrook, C.B., M.A., D.Sc., F.R.S., the Director of the National Physical Laboratory) occupied the chair; the vice-chair being filled by Mr. H. E. Neale (the Chairman of the Association). The guests included a number of names that are household words in the engineering world. Indeed, on the support from those at the head of the profession which they invariably receive, the Association are to be congratulated. The toast list and musical programme which had been arranged held out promise of a full evening's enjoyment; and expectations were not disappointed.

In addition to the Loyal Toasts, there were only three on the list. The first of these was "Science, Practice, and Technology," which was in the hands of Mr. B. A. Raworth, Wh.Sc., M.Inst.M.E., who made a long and interesting speech. In reply, Surg.-Gen. Sir Alfred Keogh, K.C.B., LL.D. (the Rector of the Imperial College of Science and Technology, and President of the Society of British Gas Industries), remarked that the toast was a very comprehensive one. If he were asked to define "technology," he would have to confess his inability to do anything of the kind. It was a term he very much disliked; but they might perhaps take it to mean the application of science. It had been said over and over again that the manufacturers in this country were very slow to take advantage of science, though whether or not this was true he would not attempt to prove. He happened, however, to be the head of a great college established for the purpose of bringing together science and industry. Perhaps the leading bodies had not done so much in this way as they might have done. He often heard college science spoken of with a certain amount of contempt. But he thought much of the trouble might be laid at the door of the industries themselves, though there was no doubt that there had been far too great a tendency to educate pupils without any regard whatever to their destinies. The college to which he belonged was established to educate young men from the beginning in a definite direction, so as to enable them later on to enter their profession better prepared than had hitherto been the custom in this country. There were, of course, great difficulties in the way; but he thought they might claim—they were a very young institution—that within the last few years they had proceeded upon lines which would, if they were known to those present, commend themselves to them. This was because the college authorities had not depended upon their own judgment as academic people. At the very outset they had had the advice of all the most celebrated men in this country, who had won positions for themselves in science and in the industries; and of this advice they had taken full advantage. It was perhaps hardly necessary to tell the members that they had at South Kensington a very

large engineering school—far and away the largest in this country, or in the Empire.

Mr. A. E. Penn (the Hon. Secretary of the Association) proposed "Kindred Institutions and Our Guests." He remarked that in the times of the old guilds the father taught the son his business, but now one hardly knew where his business was going to be taught from—at any rate, so far as engineering was concerned. Mr. Leslie T. Robertson, M.Inst.C.E. (the Secretary of the Engineering Standards Committee), in response, said he fully believed that there were more "kindred institutions" associated with the Standards Committee than with any other body in existence. It was a desirable thing for the younger members of the profession to have an opportunity of expressing their views; and therefore the junior organizations did good work. Sir Thomas D. Pile, Bart., LL.D., J.P., also replied, and said he rejoiced at the success of the Association, which was largely due to the energy and organizing skill of the Hon. Secretary.

The final toast—that of "The Association"—was proposed by Sir Boverton Redwood, Bart., F.R.S.E. (President of the Junior Institution of Engineers), who pointed out that the Association was making steady progress, and was becoming of greater value year by year. He felt bound to say that there was sometimes displayed a lamentable lack of sense of appreciation in weighing the merits of those who were to be invited to occupy positions of trust of the character of those filled by the members of the Association. He recalled an advertisement he had seen in a paper, for an engineer and a cook needed by a board of guardians. The duties required of the former were such as practical experience only could qualify for; but the respective salaries offered by the guardians to the two officials, adding in each case the estimated amount of the emoluments, were precisely the same per annum in pounds sterling. How was it possible, in these circumstances, to get the right kind of man? These things were managed better abroad. On the Continent it would be necessary for applicants for such a position to produce a certificate of proficiency and efficiency; and something of the kind was necessary here, so that the position of an engineer-in-charge could be properly defined. Then he would receive proper recognition. There was therefore much that the Association could work for. In the course of his response, Dr. Glazebrook gave an interesting account of the early work of the Royal Society. As to their own Association, there were, he said, demands for branches in the Provinces and in the Colonies; and the Council were considering how they could make the usefulness and value of the Association still better known.

THE HEALTH VALUE OF COAL GAS FOR LIGHTING AND HEATING.

By Professor Vivian B. Lewes, F.I.C., F.C.S., &c.

[Extracts from a Lecture before the Sanitary Institute, March 16.]

In considering the influence which the use of coal gas for lighting and heating has upon the health of the community the subject falls naturally into two divisions: (1) The effect on the air of enclosed spaces; (2) The effect on the outer atmosphere. Before, however, we can discuss the first, it is necessary to arrive at some conclusion as to what is to be considered harmful to health, and to fix some standard for which to strive in regulating the condition of the air in our houses.

In attempting to do this, we are met by the difficulty that there are few subjects affecting our health upon which scientific opinion has undergone more startling changes than with regard to the factors that lead to hygienic conditions in the air of our dwelling-rooms.

Professor Lewes then traced the history of investigations made from the end of the Eighteenth Century into the constitution of the atmosphere, and the effects of the exhalations from the bodies and breath of individuals, down to the recent pronouncements of Professor Haldane and Dr. Leonard Hill—quoting from the latter scientist's paper read at the Gas Exhibition Conference last autumn. Proceeding, he said: These views are now thoroughly endorsed by all those sanitary authorities who have kept abreast of the times; and from the most recent work we may formulate the conditions most conducive to health in our dwelling-rooms as being—

1. Cool, fresh, moving air in the portion of the air space of the room in which we breathe, as this, by preventing the accumulation of exhalations from the body in our clothes, allows the functions of the skin to be carried on properly.
2. Warming the room when necessary by radiant heat, which raises the temperature of the solids in the room without heating the air, and so does not raise unduly its power of causing evaporation. The feet-level should be kept warm; the head level, cool.
3. The avoidance of convected heat, which warms the air but only to a less degree the solids in the room. Hot stagnant air is the greatest danger to health.
4. Reduction of the mass influence of pathogenic bacteria in the air.

Having now gained an idea of the conditions at which to aim, we can consider how far our modern illuminants and heating devices help to their attainment. As far as the hygiene of the air both in our rooms and in our towns was concerned, the old days of the wax candle and log fire were beyond compare the most heathful; but now that the craving for more and more light has obsessed us, the incandescent mantle or electric light has become a necessity of modern town life.

Prejudices against Coal Gas.

Coal gas is a mechanical mixture of hydrogen and hydrocarbons, with small quantities of carbon monoxide and traces of sulphur compounds; the latter being reduced by purification to the lowest limits that the gas manager can attain by commercial processes. The products of its combustion are carbon dioxide and water vapour, with traces of sulphur acids.

If we seek the cause of the prejudice which still exists in the minds of a few against the use of coal gas as an illuminant, we find that it dates back to the era of the luminous flame, when, if a light of 20 candles was required in a small room, 10 cubic feet of coal gas had to be burned to give it; and the amount of the products being excessive, and the heat considerable, the idea gained ground that coal gas as an illuminant was not hygienic. Now, however, the incandescent mantle has swept the luminous flame before it; and a combustion of less than one-third of the volume of gas in an inverted mantle gives us 60 to 80 candles of light, while in large halls and in outside lighting high-pressure gas enables us to obtain 60 candles per cubic foot of gas consumed.

The ease and convenience with which a light could be obtained by the use of electricity (the mere pressing-down of a switch button being sufficient) was a feature that appealed to the popular fancy; while it was also clear that, as the light was enclosed in a vacuous bulb, no air was used-up in combustion, and no deleterious products were evolved. So that it seemed as if the electric light must be regarded as far more healthful in a confined space than when coal gas was used to give an equal illumination. In spite of this, however, the fact remained that often one felt less oppression in a room lighted by incandescent gas-mantles than when the electric light was employed; and this was most noticeable in rooms where a number of persons were present.

Facts in Opposition.

This fact was so opposed to what would be expected, that experiments were instituted to ascertain the reason. A room was selected, which would be lighted either by two Welsbach "C" burners and mantles on a pendant, with a total consumption of 8 cubic feet of gas per hour and a light of 120 candles, or by a cluster of three 16-candle incandescent electric lamps. It was found that the air at the breathing level was kept in a far more fresh and pure condition when gas was being burnt than when the electric lights were switched on, and that with an increase in the number of the inmates the result became the more markedly in favour of gas.

The cause of this was found to be that the rapid draught created by the burning gas drew up the emanations from the skin and lungs of the occupants, at the same time charring and sterilizing the organic matter with which they were loaded. The products of the combustion thus reached the ceiling at a relatively high temperature and diffused through the plaster so rapidly that a current of fresh air was drawn into the lower portion of the room under the door and through various openings; while the charred organic matter was filtered off by the ceiling, giving the blackened area which is always seen above gas-burners in towns, and which is not due, as is generally supposed, to imperfect combustion.

Dr. Rideal also made experiments of the same kind; and his valuable paper on the subject (published in 1908) thoroughly bears out the view that the products of combustion are not found in the air in anything like the proportion which might be expected. Also that the temperature and humidity in an occupied room where gas is used as the illuminant are no greater than when the room is lit with electric light.

Experiments made by various observers, both in this country and abroad, have confirmed the above facts; and no evidence has been adduced to the contrary. All the results show the importance of the heat given off by the combustion of the gas, whereby the air is set in motion, diffusion is promoted, and fresh air drawn in to a considerably greater extent than when electric lighting is employed. The latter certainly gives off no products; but owing to the lower temperature produced, it has a much smaller influence in creating motion in the air.

The Breathing Zone of a Room the Important Zone.

It must be clearly borne in mind that the superior purity of air when gas is used as an illuminant is in the breathing zone of the room only, and is brought about by the concentration and removal by diffusion of the hot air and impurities from the zone above the level of the burners. If the temperature and chemical

purity of the air in both the upper and lower zones be tested after the room has been lighted (and inhabited for some time) with electric light, it is found that the variations in temperature between the upper and lower zones differ but little; and the same with the purity of the air. But when the lighting is done by the incandescent gas-mantle, the zone above the burner is far hotter and more impure than the breathing space or lower zone. The heat of the burner is making a cesspit of the upper part of the room, into which the emanations from the lungs and body rise, owing to their being warmer than the surrounding air; and in the hot zone they are kept up in temperature until discharged, by diffusion, with the products of combustion of the gas.

Sulphur Products.

It will be well at this point to consider the question of the action of traces of oxides of sulphur present in the products of combustion yielded by the gas-burner. There is no doubt that when luminous flames were employed and large volumes of gas consumed, in places where the gas was insufficiently purified a taint of sulphur compounds was perceptible in the products; but even then, with gas as sent out by the large companies, little or nothing was detected by the nose, and the damage generally credited to sulphur was more often traceable to sulphur in the outer air due to pyrites in the coal used as fuel. [The lecturer then alluded to the well-known inquiry on this subject of Mr. Otto Hehner and Dr. Samuel Rideal.] He resumed: At the present time experiments are in progress which seem to show that the gas industry is within measurable distance of obtaining a method of sulphur purification which will reduce the percentage of sulphur compounds other than sulphuretted hydrogen to a lower point than has ever been possible before, and which will remove any possible objection on this score to the use of gas.

The Heating of Rooms.

When we turn from the illumination of our rooms to their heating, we find that the coal-fire heats by radiation and not by convection, causing a brisk draught in the chimney, and were it not for its fatal effect on the outside atmosphere, by its dirt and the labour it entails, and by its waste of our rapidly diminishing natural store of fuel, would leave little to be desired. These objections, however, are so grave and so insuperable that at the present time every thinking person feels that, in the interests of humanity, the open fire-grate consuming bituminous coal should cease its work of polluting the atmosphere.

The air is the heritage of the community. We have no more right to foul it than we have to poison the water supply; and the effect of coal smoke on the air of our large cities and towns, in fostering fog and diminishing the chemical activity of the sun's rays (on which all life is dependent), has been so clearly proved that, apart from its dirt, the health of the country demands its abolition. To do this, other methods of heating must be adopted. Smokeless fuels have not yet proved a success; and once more we find coal gas and electricity entering into rivalry. In this case, however, cost puts electricity entirely out of the competition—even if the claims of hygiene did not enter into the question. Dr. Muecke and Dr. Leonard Hill, in a series of experiments upon the condition of the mucous membrane of the nose and throat in persons submitted to (1) fresh air, (2) the warm air of a chamber heated by electric heaters, wherein the head-level is several degrees hotter than the feet-level, found that under the latter conditions the membrane became congested, swollen, and covered with thick secretion, a condition which causes feelings of stuffiness, headaches, and obstructed nasal breathing, and increases the liability to infection—these symptoms being due to the electric heaters doing their work chiefly by convection.*

The early forms of gas-stove for the same reason undoubtedly created a great amount of prejudice against the use of gas for domestic heating; the gas-stove makers not realizing that it was essential to healthy heating that radiation only, and not convection, should be employed.

Up to five years ago the stoves most used converted often less than 30 per cent. of the heat of combustion of the gas into radiant heat; while, in order to bring-up the heating efficiency, the hot products were led into chambers above the radiant face of the stove, and were made to heat air which discharged into the room—so utilizing another 30 per cent. of the heat in convection. By thus heating the air, a rapid warming was secured; but the power it possessed of absorbing moisture was so increased that smarting eyes and dry throats led to the fallacy that the gas-stove "dried" the air, and to neutralize this bowls or other vessels of water were generally found on, or in front of, the stove—the idea being that the evaporation would supply enough moisture to counterbalance the "drying" effect. The flue outlet for the products to the chimney and the canopy over the radiant front of the stove also were often so badly proportioned that a not inconsiderable amount of the products of combustion escaped into the air and accentuated the trouble given by the convected heat.

The Old Prejudice of Doctors Removed.

These factors led to the medical profession discouraging the use of gas-stoves in bed-rooms, and created in the lay mind considerable prejudice against their use. When, however, the cause of the trouble was recognized, the gas-stove maker strove at once to remedy it, and by doing away with the heating-chambers, improving the forms of the refractory material used as "radiants" in the stove, and specially studying the effect of the flue exit and the arrangement of the canopy so as to prevent any escape of products into the room, made such improvements in the modern gas-stove that 50 per cent. radiation and often less than 20 per cent. of convection are obtained in most modern stoves, and even higher efficiencies are talked of.

One of the leading manufacturers has even gone so far as to devise special "Shadowgraph" tests, by which the smallest leakage of the products of combustion from under the canopy can be detected. The gas-stoves of to-day thus leave but little to be desired from the hygienic point of view—more especially as by setting them properly they can be made to withdraw 4000 to 5000 cubic feet of air per hour by the chimney draught. They thus go a long way towards creating the air movement in the living space that sanitation demands; while the vertical portion of the "radiants" heats the floor without unduly warming the area from which we breathe—so giving the warm feet and cool head necessary for health.

The success of these efforts to fit the gas-stove for use in the dwelling-room is best shown by the attitude of the medical profession towards them. Their value for warming the bedroom before retiring for the night and rising on a cold morning in the case of bronchial tendency, the ease of regulating temperature, and the absence of noise in the sick room, the doing away with the necessity of giving the fire constant attention in the study, and the freedom from ash and dirt wherever they are used, have led to their wide introduction. From the domestic standpoint the saving of labour in carrying coal, cleaning grates, and removing ash and dirt are a big asset; while a gas-heated hot-water system, although less economical than a special coke-fired boiler, gives a guarantee of being able to secure hot water at any hour, which is conspicuous by its absence when a hot bath is dependent on the cooking arrangements.

Gas for Cooking.

From the culinary standpoint the gas-cooker has long since lived down all prejudice; and from the penny-in-the-slot cooker of the labourer to the gas-ranges of our premier restaurants gas as a cooking fuel actually "rules the roast." A consideration of these points leads to the conclusion that the health value of coal gas for lighting and heating in our homes cannot be overrated, and that with careful attention to the fitting of burners, plain whitewashed ceilings, and really good radiant stoves, the health conditions now recognized as being the most important can best be obtained by its use.

Gas and its Effect on the Atmosphere.

When we come to the second part of our subject, we find that the atmosphere of London is the best demonstration that can possibly be found as showing the effect that the rapid introduction of gas for heating is having upon the air.

In considering the effect of coal gas on the outer atmosphere from the hygienic point of view, it is clear that it is only as a fuel that we need consider its action, and as its products of combustion are only carbon dioxide, water vapour, and a trace of sulphur oxides, its use means the abolition of smoke with its attendant evils. When we come to consider the contamination of the atmosphere by sulphur acids, we find that, in order to obtain the same number of thermal units as are contained in 1 lb. of good coal, we must use about 30 cubic feet of gas, which will contain on an average 14 grains of sulphur; while as coal often contains over 1 per cent., the pound of coal will contain at least 70 grains, or five times as much.

In burning the coal in our grates, however, only 20 per cent. of the heat is utilized in raising the temperature of the room, while with a good gas-stove we utilize 60 per cent. at least. So that the higher efficiency of gas as a fuel reduces the amount of sulphur acids to one-fifteenth of that evolved for an equal amount of heating.

Statisticians tell us that London's annual soot-fall amounts to over 76,000 tons a year—containing a large proportion of tar. But far larger is the amount of tar in the cloud of floating vesicles that gives the overhead gloom, that filters from the sunshine the actinic rays that are the mainspring of life, that all too rapidly chokes growing vegetation, and converts the town-bred plant into a parody of its country prototype, and finally leads to enormous financial loss by aiding the formation of fog and preventing its dispersal by the sun's rays. Slowly but surely the adoption of the gas-stove is improving these conditions. It is computed that one-sixth of the fires used for domestic purposes have been converted from coal to gas. The atmospheric conditions in London are reflecting the change by a steady improvement; the hours of sunshine are steadily increasing; and the London fogs are as steadily decreasing, both in number and virulence.

Over 1,600,000 coal-fires have been replaced in London by gas-stoves; and there are many who, seeing the improvement this has wrought, hope that in the not very distant future bituminous coal as a fuel may be replaced entirely by gas and coke—a possibility even in our manufacturing districts, where the use of high-pressure gas for industrial purposes is advancing with rapid strides.

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* See "Journal," Vol. CXXII., p. 717.

Mr. Salomon Falk, founder and Managing-Director of Messrs. Falk, Stadelmann, and Co., Limited, of Farringdon Road, left estate of the gross value of £122,133, of which the net personalty has been sworn at £121,068.

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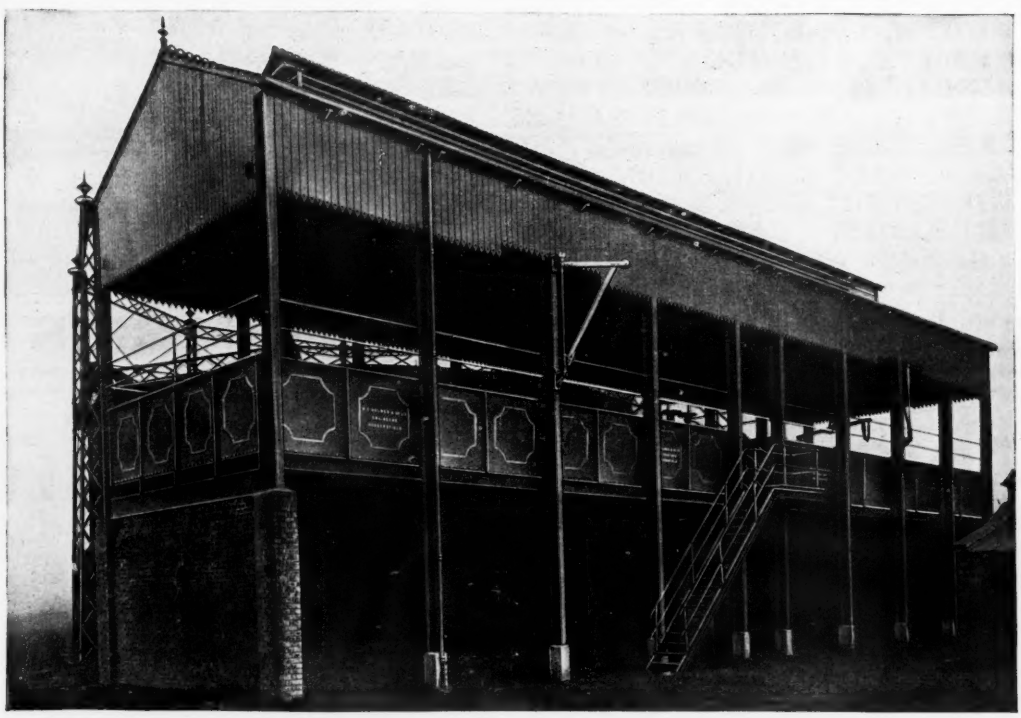

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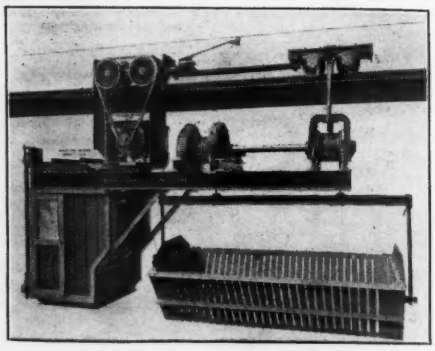

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Edward Allen, Esq., Liverpool, at the recent Institution Meeting, said:

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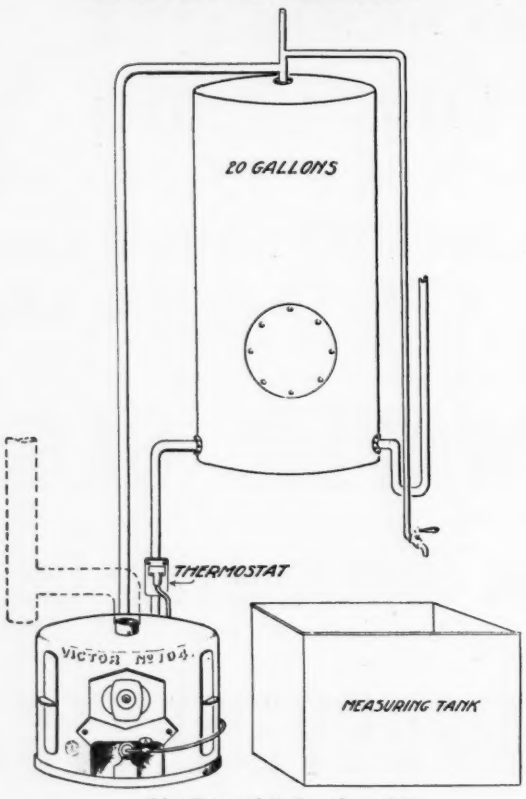

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SOCIETY OF BRITISH GAS INDUSTRIES.

THE Annual Meeting of the Society was held on Thursday last, at the Trocadero Restaurant. Professor HAROLD B. DIXON, Ph.D., F.R.S., the President, was in the chair; being supported by the retiring Chairman of the Council, Mr. W. D. Helps, and the incoming Chairman, Mr. J. W. Broadhead. There was a large muster of members.

The SECRETARY (Mr. Arthur L. Griffith) presented the minutes of the last meeting; and they were confirmed.

REPORT OF THE COUNCIL.

In presenting the eighth annual report to the members of the Society, your Council have pleasure in recording continued progress in various ways, and a further increase in membership.

Your Council regret to record the death of their esteemed and respected colleague, Mr. J. Armitage Drake, J.P., who always showed himself much interested in the work of the Society, and at all times did what he could to further its welfare.

The notable feature of the year was the very successful National Gas Congress and Exhibition held in October, which was a great co-operative scheme demonstrating to the public the immense advance made in the use of gas during the last hundred years, and the general progress of the industry. Your Council desire to tender to you their best thanks for your cordial and loyal support in this matter.

The British Commercial Gas Association, with which the Society has been closely identified, has done valuable work during the past year—especially in the prominent part it took in connection with the National Gas Congress and Exhibition, in addition to its advertising campaign. The second annual conference (held in October in the historic Guildhall of the City of London, by the courtesy of the Lord Mayor) was a pronounced success, and many of our members were present and took part in the proceedings. The Council desire to press the strong claims of the Association upon the members of this Society who have up to the present not identified themselves with same by contributing to its funds.

The British Trade-Mark Association has been recently formed for the purpose of protecting goods of British manufacture, as it is well known that at the present time considerable quantities of foreign goods are placed on the English market as of British manufacture, and many articles enter the Colonies under the lower duties intended for wares of actual British origin. In some cases the evasion is secured by means of false declarations; and it is considered that if a "British Empire Trade Mark" was adopted, signifying manufacture under the flag, it would put a stop to this, and draw closer together the relations among all British manufacturers. The Society having been invited to join the Provisional Committee of the Association, your Council have nominated your Chairman and Secretary to represent you.

Having in view cheaper transit facilities due to canal development in Germany, France, and Belgium—the countries chiefly competing with our manufacturers in our own and foreign markets—and the congested conditions of transit of heavy and bulky goods in this country, a resolution was passed at the autumn meeting of the Society urging the Government to act upon the recommendations of the Royal Commission on Canals, and appoint a Water-Ways Board. A copy of this resolution was duly forwarded to the Prime Minister.

The President of the Institution of Gas Engineers having suggested that there should be a closer linking together of the chief Associations connected with the gas industry, a Committee (composed of seven representatives from each body) has considered the matter; and its proposals for the establishment of a Joint Standing Committee to consider from time to time important questions of general interest to the industry will be submitted at the annual general meeting.

The Society is greatly indebted to Professor Harold B. Dixon, Ph.D., F.R.S., the retiring President, for the keen interest he has taken in its welfare, and tenders to him their very cordial thanks for his valuable services. The Council have pleasure in announcing that he has accepted a vice-presidency, and hope they may long continue to have the benefit of his experience and advice. They are much gratified by the honour conferred upon him by His Majesty the King in awarding him a medal of the Royal Society.

Sir Alfred Keogh, K.C.B., LL.D., M.D., Rector of the Imperial College of Science and Technology, South Kensington, has kindly accepted nomination as President of the Society for the coming year.

The Society desires to record its best thanks to Sir Corbet Woodall, J.P., D.Sc., M.Inst.C.E., for his able presidential address at the last annual general meeting; and also to express its appreciation of the interesting paper by Mr. W. D. Helps, entitled "Thoughts: By One who Thinks," at the autumn meeting, which led to such a very useful discussion.

It having been suggested that a die should be adopted by the Society for the use of members, similar to that used by the Engineering Employers' Federation and other Associations, the Council will submit their recommendation to the members at the annual general meeting.

Your Council wish to again impress on the members the desirability of making full use of their respective sections, and when any important matter of general interest to any section or to the Society arises, members should request the Chairman of their section to call it together for the purpose of considering same, as this is the only way that the Society can attain its full usefulness.

On behalf of the Central Council,
WILLIAM D. HELPS, Chairman.

Feb. 18, 1914.

On the motion of the CHAIRMAN (Mr. W. D. Helps), seconded by Mr. THOMAS GLOVER (London), the report was adopted.

The financial statement for 1913 was passed, on the proposition of Mr. PERCY F. HOLMES, seconded by Mr. H. DOUGLAS BURN.

OFFICE-BEARERS FOR THE CURRENT YEAR.

Mr. HELPS announced the names of the gentlemen who had been elected to serve on the Central Council as representative of the sections for the ensuing twelve months [see list below].

Mr. HELPS moved, and Mr. A. P. MAIN seconded, the election of Mr. J. W. Broadhead as Chairman of the Council for the ensuing twelve months.

The motion having been cordially passed,

On the proposition of Mr. BROADHEAD, seconded by Mr. F. C. TILLEY, Mr. F. Templer Depree, J.P., was elected Vice-Chairman.

Proposed by Mr. T. S. CLAPHAM, seconded by Mr. T. E. UPJOHN, Mr. H. M. Thornton, J.P., was re-elected Honorary Treasurer.

Moved by Mr. B. B. WALLER, seconded by Mr. F. J. GOULD, Mr. Cyril G. Davis was re-appointed Honorary Secretary.

Mr. TEMPLER DEPREE moved, and Mr. JAMES W. WILSON seconded, the election of Mr. W. D. Helps as an elective member of the Council.

This was unanimously agreed to.

Mr. SAMUEL CUTLER, JUN., proposed, and Mr. R. J. MILBOURNE seconded, the re-election of Messrs. F. J. West, H. James Yates, and T. S. Clapham as elective members of the Council.

The following is a complete list of the officers for the current year:

President:
Sir ALFRED KEOGH, K.C.B, LL D.

Vice-Presidents:
DUGALD CLERK, D.Sc., F.R.S.
THOMAS NEWBIGGING, D.Sc., M.Inst.C.E.
J. H. BALFOUR BROWNE, K.C.
Professor ARTHUR SMITHELLS, F.R.S.
Sir CORBET WOODALL, D.Sc., M.Inst.C.E.
Professor HAROLD B. DIXON, Ph D., F.R.S.
CHARLES CLARE.

Central Council:
Chairman: J. W. BROADHEAD, M.Inst.M.E.
Vice-Chairman: F. TEMPLER DEPREE, J.P.

W. P. GIBBONS	Representing Section		I.
PERCY F. HOLMES	,,	,,	II.
SAMUEL CUTLER, JUN., A.M.Inst.C.E.	,,	,,	III.
T. V. MILES	,,	,,	IV.
THOMAS GLOVER	,,	,,	V.
JAMES W. WILSON	,,	,,	VI.
F. C. TILLEY	,,	,,	VII.
T. E. UPJOHN	,,	,,	VIII.
H. N. BICKERTON	,,	,,	IX.
G. H. PEARSON PERRY	,,	,,	X.
B. B. WALLER	,,	,,	XI.
JOSEPH TAYLOR	,,	,,	XII.

F. J. WEST, H. JAMES YATES, T. S. CLAPHAM — *Elective Members.*

CYRIL G. DAVIS, *Honorary Secretary*; H. M. THORNTON, J.P., *Honorary Treasurer* — *Ex-officio Members.*

Secretary: ARTHUR L. GRIFFITH, 46, Queen Victoria Street.

UNION.

A report was then presented of the Special Committee regarding closer union with kindred organizations; but the consideration of this matter was *in camerâ*.

DIE FOR THE USE OF MEMBERS.

The members then considered the question of the adoption of a die for use by firms who are on the roll of the Society. This will distinguish in correspondence those firms who are members and those who are not. The design adopted is shown in the accompanying engraving.

INAUGURAL ADDRESS.

The PRESIDENT then delivered the following Inaugural Address, which was extensively illustrated by lantern slides:

Your Past-Presidents have all of them been men of singular distinction in different spheres of activity, and they have addressed you on subjects which by long training and experience they have made their own. And yet they have all offered some sort of apology for talking to you on the things they know best; and most of them have also offered you their respectful sympathy on a misfortune which appears common to our time. Let me discharge my debt of sympathy first. I condole with you on the excessive mildness of the winter, and deplore that clemency of weather which, I gather from your presidential addresses, seems to be dangerously near to becoming perennial in Britain.

Now each President has spoken, rightly, as I think, of the things that were nearest to his daily thoughts and work; and since my own thoughts have been for many years more or less focussed on

flame, I make no apology for speaking to you on a subject in which we must all be interested directly or indirectly. But I would ask your kindly consideration and patience for what must seem to some of you an abstruse discussion of problems remote from daily use. No worker in pure science can say that his results will have any immediate application. We may be sure, however, that in the long run every discovery will find its place in, and will complete the theory that guides, industrial practice. I have only to look back on the period when I began to study flames, forty years ago, under the guidance of that patient experimenter Mr. Vernon Harcourt, to see how new results and ideas that were regarded then with scepticism or distrust by the orthodox have now become commonplaces. For instance, I am no longer alarmed that a German professor will question the fact that water vapour influences the explosion of carbon monoxide and oxygen; the idea of water as a go-between soon "caught on." Now I am much more concerned at receiving (as I do about once a month) a letter saying "Please give me the reference to your proof that nothing will burn or explode unless it is wet." The experiments relied on by Bunsen to prove that an explosion of gases took place in successive stages, and that the spread of the flame synchronized with the attainment of maximum temperature and pressure, are now explained in other ways. The phenomena of the slow initiation of explosions and the sudden development of the explosion-wave are now familiar; indeed, results are often attributed to an explosion-wave under conditions which seem very unlikely to give rise to one.

Again, the structure of the flame of the Bunsen burner was unknown to us until your former President, Professor Smithells, dissected it and demonstrated to us that there were two flames—the inner flame due to the admitted air burning in the coal gas, and the outer one due to the products of the first flame and the excess of coal gas burning in the outside air. This was as beautiful a demonstration as any of Faraday's classical experiments on the structure of a candle flame. The mention of Faraday's lectures on a candle inevitably reminds us that he taught us that the separation of the carbon in a luminous flame was due to the hydrogen in a hydrocarbon having a greater affinity for oxygen than the carbon had. This idea of the preferential combustion of the hydrogen was one of the die-hard doctrines connected with flame. Though apparently knocked-out, it came up again with astonishing freshness, and only received its final *quietus* at the hands of that straight and scientific hitter, my old pupil, Professor Bone.

But these are now matters of ancient history. What are the vexed questions of to-day? To bring home to you some of the problems that confront the flame-chemist, let me ask a few questions bearing on the nature of flame—questions to which I have been trying to find answers.

(i.) What is meant by the ignition-point of a gas? Does chemical combination begin abruptly at that point? We find, for instance, that at ordinary pressure, when a jet of hydrogen enters an atmosphere of oxygen, we have to heat the two gases to about 580° C. before the hydrogen ignites in the oxygen. Is *that* the temperature of the mixing gases at the moment when the flame appears, or has flameless combustion carried the gases to a much higher temperature before we see the flame?

(ii.) What are the temperatures reached in gas-flames—either when gases are burnt in the atmosphere or when gaseous mixtures are exploded in vessels? Can we determine the specific heats of the products of combustion, and can the losses of heat during the progress of the combustion be estimated?

(iii.) How is flame propagated through an explosive mixture? Is it by a process of diffusion of "burnt" molecules from a burning layer into the contiguous layer of "unburnt" molecules, and the gradual heating-up of the unburnt gas to the temperature of ignition? Or is the process one of direct action on collision, or of transference of momentum by collision between "heated" and "unheated" molecules—such transference endowing the yet unburnt molecules with the power of combining with their "chemical opposites" when they in turn meet, or do both these processes occur, and is the uniform and slow-moving initiatory period the result of the first process, and the uniform and rapid explosion-wave the result of the second?

(iv.) And lastly, is the chemistry of combustion in flame a simple process of direct oxidation, or is it conditioned by the catalytic action of other bodies—particles of water, molecules, or electrons?

The Ignition-Point of Gases.

I think the experiments that have been carried out in the University Laboratories at Manchester have thrown light on many obscure points in the combination of gases. In the first place, it has been shown (especially in the long series of experiments carried out by Dr. Bone) that chemical combination occurs between gases in contact with heated surfaces a long way below the temperature of ignition. More recently Dr. Coward and I showed that contact with a heated surface raised the temperature of ignition. The heated surface did not stop chemical combination, but it prevented the combination becoming so rapid as to develop into flame—under conditions when it would have produced flame if the surface had been absent. In order, therefore, to approximate to the true temperature of ignition, it was necessary to bring the heated gases together as far as possible from any solid surface.

The fact that a solid body prevents the ignition of a gas mixture in contact with it, although the solid is heated well above the ordinary ignition-point of the gas, suggests at once that the flame does not really appear at the ignition-point, but at some higher temperature which the gas attains by pre-flame combustion. The solid, by its great capacity for heat, compared with the gas in contact with it, keeps the temperature down, and so acts as a brake on the chemical combination.

The ingenious suggestion of Professor Nernst to heat up a mixture of gases by sudden compression, and to calculate the temperature of the mixture from the volumes before and at the moment of greatest compression, enables the gases to be heated without any appreciable heating of the walls. The experiments made by Mr. K. G. Falk, with a falling weight and a steel cylinder and piston on the compression of varying mixtures of oxygen and hydrogen, apparently established the fact that the mixture most easily ignited was that in equal proportions—indicating that the primary reaction between hydrogen and oxygen was to form not water, but hydrogen peroxide. This result was so contrary to the evidence afforded by the rates of explosion of hydrogen and oxygen mixtures, that I was led to make a careful examination of the

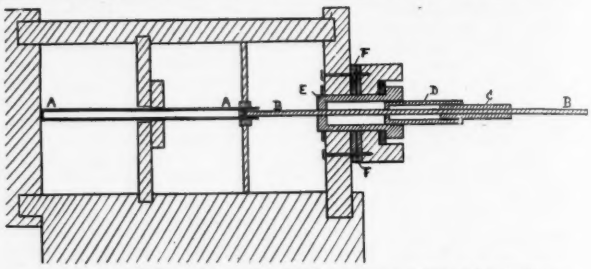


Fig. 1.—Glass Tube (AA) for the Sudden Compression of Explosion Mixtures.

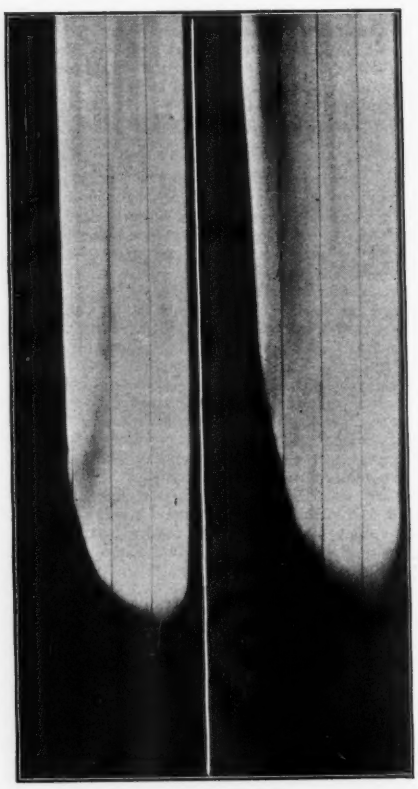


Fig. 2.—Photographic Analysis of Flames Produced by Sudden Compression.

compression method. Nernst had laid down the principle, which appeared axiomatic, that since the whole gas column was compressed and heated to the ignition-point, the flame must spread through the gas as an explosion-wave, and therefore the time that elapsed between the initiation of the flame and its meeting and reversing the motion of the piston could be neglected. Falk, accordingly, did not check the movement of the piston artificially, but, by means of a sliding collar, observed the greatest depth reached by the piston before it was shot upwards by the force of the explosion. Now with a very sensitive mixture, such as electrolytic gas, the pre-flame period is short; and the flame once started rapidly sets up the explosion-wave. Consequently, the piston has not time to move forward appreciably after it has compressed the gases to the ignition-point, and no sensible error results from allowing the flame itself to check the piston. But when an excess of oxygen was added to electrolytic gas, so that the volume of oxygen was three times that of the hydrogen, then the pre-flame period was so prolonged

that the piston had time enough to move in a long way after the "ignition-point" was reached before it was stopped by the flame. Even after the appearance of the flame in this slow-burning mixture the piston moved forward an appreciable distance. The distance, therefore, travelled by the piston did not give the true ignition-point, but gave a much higher temperature. The method of photographic analysis which I had employed for the study of the explosion-wave, enabled the pre-flame period to be studied when the gases were compressed by a steel piston in a strong glass tube. [Figs. 1 and 2.]

When the gases are compressed to the ignition point and the movement of the piston is artificially arrested at this moment, a flame appears after an interval at some spot in the heated gas and spreads slowly throughout the mixture. *The flame does not start as an explosion-wave*, which is characterized by its great and uniform velocities, as shown in fig. 3. In electrolytic gas it quickly sets up an explosion-wave, but in a dilute mixture, such as 1 of hydrogen to 3 of oxygen, the flame travels comparatively slowly. In the latter mixture it is possible to compress the gas into a volume one-third that required for heating it to the ignition-point—before the flame actually appears. Now the chemical combination begins below the ignition-point, but the heat given out by this combination is not sufficient to overcome the loss of heat to the walls. At the ignition-point, the combination is rapid enough to overcome this loss, and the gas rises in temperature. But if the compression is continued during this pre-flame period, the gas is heated-up both mechanically and chemically. The photographic analysis shows that the gas was heated in the experiment by the mechanical compression alone to 975° C. before the flame appeared. Actually the gas reached its self-heating (or ignition) point at about 500° C., and was therefore rapidly rising in temperature from the chemical combination as well as from the mechanical compression. It is obvious then that the temperature of the gas when the flame appeared was well over 1000° C. The time that elapsed between the gas reaching its ignition-point and the actual production of flame was about $\frac{1}{100}$th of a second. The pre-flame period of combustion is thus seen to be a definite stage in the combination of gases. Some gases have longer pre-flame periods of combustion than others. Methane has a remarkably prolonged pre-flame period. It is in this initial stage of the combination of gases that the influence of water vapour (studied by Professor Brereton Baker) appears to be exerted. Pure mixtures of hydrogen or a hydrocarbon with oxygen are kindled by a spark however thoroughly they are dried, and the flame traverses the mixture more rapidly than when water vapour is added.

Fig. 3.—Explosion-Wave Photographed on Rapidly-Moving Film.

With the large steel cylinder shown in fig. 4 it is possible to determine with considerable accuracy the ignition-points of gaseous mixtures. The plunger A compressing the gases is a gun-metal piece screwed on to the steel-piston rod and making a good sliding fit with the smooth steel cylinder. The leather ring B makes the fit gas-tight. The piston-rod C is fitted at its upper end with a strong steel headpiece, which is caught at the desired moment by the series of rings E forming a collar through which the piston is driven by a falling weight until the headpiece is suddenly arrested by the collar. The depth of the collar can be adjusted to ·1 of a millimetre. With this apparatus successive trials are made, in which the compression is increased until the mixture fires. Under the high-pressure produced by the compression gases are fired at a lower temperature than when they are heated at ordinary atmospheric pressure. For instance, electrolytic gas has an ignition-point about 585° C. at one atmosphere; when fired by adiabatic compression, the ignition-point is found to be 526° C. It is a curious fact that successive additions of oxygen to electrolytic gas lower the ignition-point of the mixture.

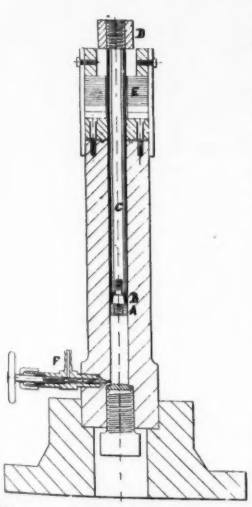


Fig. 4.—Steel Cylinder for the Sudden Compression of Gases.

Specific Heats of Gases at High Temperatures.

The determination of the heat capacity of gases at high temperatures has for a long time presented grave difficulties to the experimentalist. The heat capacity of the gas is so small compared with that of any vessel which is used to confine them, that variations in the specific heat of the gas are very difficult indeed to detect; and if the gases are passed into a calorimeter through a heated coil, it is difficult to allow for the heat which is conducted along the pipe. As a consequence, the heat capacity of gases has usually been measured at comparatively low temperatures; and from the data so obtained curves have been drawn to higher temperatures outside the range of the experiments. Such curves are largely guesswork; and yet to arrive at the true temperature of flames and to formulate a theory of gas explosions, it is a fundamental requirement to have an accurate knowledge of the specific heats at temperatures ranging from 2000° C. to above 5000° C. Indirect methods have therefore been attempted—methods which are independent of the heat capacity of the containing vessels. For instance, by measuring the velocity of sound in the heated gas, by measuring the pressures produced in the compression of or in the explosion of gaseous mixtures, or by calculating backwards from the velocity of the explosion-wave in gases.

I have tried both direct and indirect methods. I began by trying the direct method of dropping a steel bomb into a calorimeter (1) empty, and (11) filled with the gas under pressure. It was possible to make a steel vessel weighing 150 grammes capable of holding 3 grammes of carbon dioxide, and holding it tight when heated to 400° C. But I found it practically impossible to ensure that the temperature of the bomb should be exactly the same in the two parts of the experiment; and this ruined the accuracy of the measurement. It was only by having two exactly similar bombs, and by heating them symmetrically in the same furnace, and by dropping them at the same moment into two calorimeters placed in one thermostat, that I could be sure of measuring the heat contained in the carbon dioxide enclosed in one of the bombs. I satisfied myself that the specific heat of the gas increased appreciably with the temperature; but the strength of the steel would not allow me to heat the charged bomb beyond 400° C., and I had to keep the calorimeter well above the critical point of carbon dioxide. The result, therefore, only gave the mean specific heat between 40° C. and 400° C.

On the other hand, the velocity of sound in a heated gas gives, not the *mean* specific heat between the ordinary temperature and the temperature of the gas, but the specific heat at the temperature of the experiment. The method requires great accuracy in the measurement of the velocity of the sound wave; but the long experience gained in the measurements of the explosion-wave made me feel confident that the rates of sound could be measured well within 1 per cent. It was in the provision of a tube which would stand a high temperature without being acted upon chemically by the gases, and in heating the tube uniformly to a known temperature, that the real difficulties were encountered. A coil of steel pipe heated in a large gas-fired retort gave me the means of measuring the velocity of sound in nitrogen to 1000° C.; but I could only get the retort approximately uniform in temperature by cutting-off all access of air, and allowing it to cool slowly while the sound waves were being measured in the pipe. The steel pipe, though coated with magnetic oxide, was attacked by carbon dioxide above 500° C. I then had recourse to a silica tube 50 feet long, heated electrically by platinum wire coiled closely along it—the whole being packed in Kieselguhr in an iron furnace. I pass over many disappointments and disasters, which the Thermal Syndicate, of Wallsend-on-Tyne, did their best to repair.

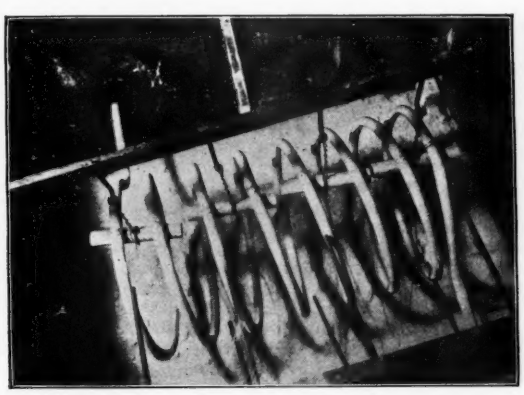


Fig. 5.—Tube, Fifty Feet Long, Suspended in Furnace.

The fourth silica has stood the test of alternate heating and cooling from 0° C. to 1000° C., and has remained gas-tight during the past year. We had to study how such a fragile coil could be suspended without strain, and how the heating would affect the position of its two ends. The photograph fig. 5 shows how the coil is supported by silica rods, which are themselves suspended from a steel rod across the furnace. Each end of the tube where it emerges from the furnace is fitted with an aluminium transmitter and receiver kept cool by water-jackets [see fig. 6]. The sound wave produced by the blow of a hammer on a metal membrane breaks a delicate electric contact a few inches from the membrane, travels through the gas in the heated tube, and breaks the similar electric contact at the other end. In a few seconds

another sound wave is sent backwards from the further end, and is registered the same way. The electric connections of the chronograph are then all reversed, and the two experiments, forwards and backwards, are repeated. The four measurements of the sound wave give a mean value which is taken as one determination—independent of any retardation of the electro-magnets or of any current in the gas filling the tube.

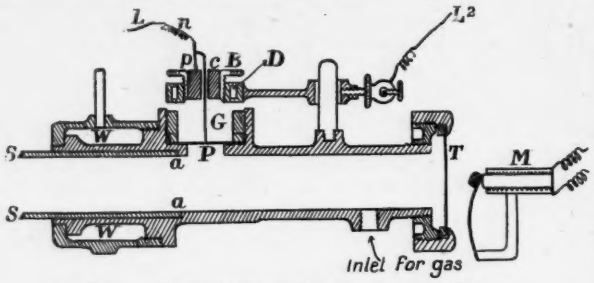


Fig. 6.—Transmitter and Receiver of Sound-Wave.

The temperature difficulty I cannot overcome. I am therefore attempting to circumvent it. It seems impossible to heat so long a tube to a perfectly uniform temperature. But it seems possible to keep it *constant* by maintaining all the conditions constant for a long period. When the tube has reached this constant state—after five or six days—it is possible to determine the velocity of sound in different gases *under the same conditions*. I have determined the velocity of sound in (1) nitrogen, (2) carbon dioxide, (3) nitrogen, (4) methane, and (5) nitrogen, without detecting any difference in the velocity of sound in nitrogen—as measured in the first, third, and fifth series. We may assume, therefore, that the velocities in carbon dioxide and methane were measured under the same conditions. If, therefore, we knew the specific heat of nitrogen, which does not vary much between 0° C. and 1000° C., we could calculate the specific heat of the other gases. To confirm these values, we have compared the velocities of sound in nitrogen and in argon—the latter chosen, of course, on account of its simple molecule (consisting of a single atom) and its constant specific heat. How these comparative measurements should be interpreted will be a matter for future discussion. I hope they will supply data for mathematical treatment.

Damping-down the Explosion-Wave by Inert Gases.

The mathematical treatment of the problems of the explosion-wave by Mr. D. L. Chapman in England, and by Professor Jouguet in France, has opened a new chapter in the theory of explosions. Convinced that their general conception of the propagation of the wave was true, I have been endeavouring for the past few years to determine the constants with greater accuracy. One of my main objects has been to use the easily-determined velocity of the explosion-wave as a means of calculating the specific heats of the gases formed at very high temperatures. For instance, if it were possible to show that the equation derived from the velocity of sound in nitrogen at 500° C. also gave the specific heat of nitrogen as determined by the velocities of the explosion-wave in mixtures of cyanogen, nitrogen, and oxygen between 3500° C. and 5000° C., then we might fairly assume that the specific heats at intermediate temperatures would be given by the curve. We might then compare the damping effect on the explosion of cyanogen by other inert gases, including argon, and so obtain comparative measurements of their specific heats.

In repeating the experiments I made twenty years ago on the the damping effect of nitrogen on cyanogen explosions, I hit on an unsuspected source of error. I had found that when electrolytic gas was mixed with varying proportions of nitrogen, it made no difference whether the tube in which the explosion travelled was 9 mm., 12 mm. or 15 mm. in diameter. When cyanogen was exploded with its own volume of oxygen, it made no difference whether the tube was 6 mm. or 9 mm. in diameter. I made the rash assumption that, when nitrogen was added to the cyanogen mixture, the diameter of the tube above 9 mm. would not affect the result. I was wrong. With diluted cyanogen mixtures the propagation of the flame is not so fast in narrow as in wider tubes; and my old results, which appeared to prove that the specific heat of nitrogen must be constant, are found no longer to hold. What is curious is that the amount of the error should have agreed so closely with a simple formula which had apparently proved itself by successful prediction. The moral is: "Never really believe in your hypothesis; use it, but do not trust it." My only satisfaction is that I have discovered its trickery myself.

Propagation of Explosions in a Magnetic Field.

It has been suggested by Sir J. J. Thomson that the great velocity of the explosion-wave may be due to the effect of electrons shot out from the gaseous molecules in the act of combination. Such electrons darting forward in front of the wave might prepare the way by ionizing the gases about to be burnt, and so greatly increase the rapidity of chemical combination in the flame. He also suggested that if this were the case, it might be possible to detect it by making the explosion travel in a powerful magnetic field which would curl-up the paths of the electrons and prevent them ionizing the unburnt gas.

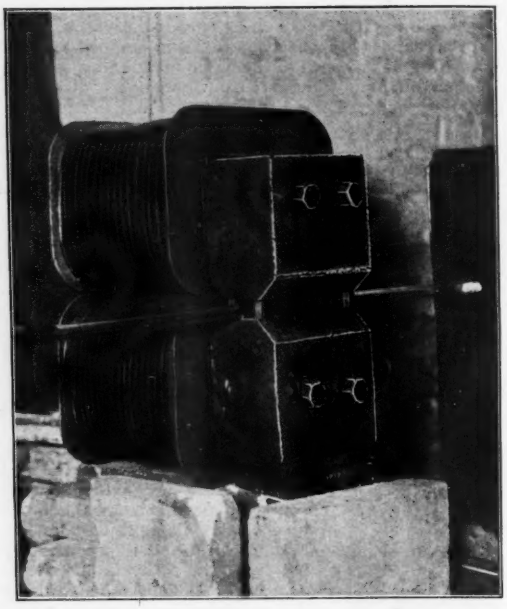
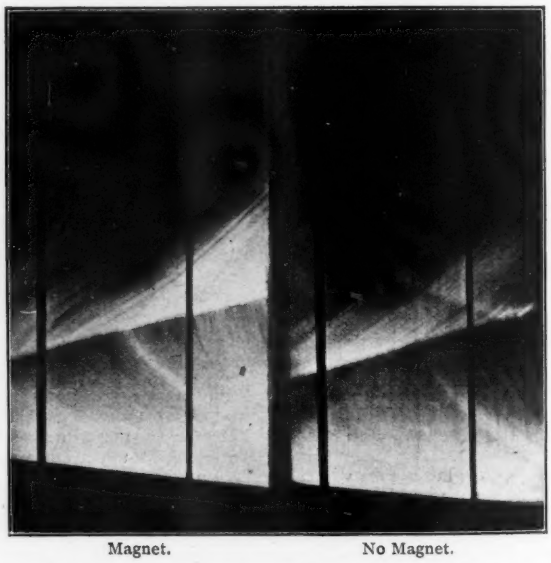


Fig. 7.—Explosion Tube placed between the Poles of Electro-Magnets.

With the aid of a very powerful electro-magnet constructed by Sir E. Rutherford, I have photographed on the moving film the flames of many gaseous mixtures as they passed into, through, and out of the magnetic field. The photographs show no effect on the flame due to the action of the magnet. We must suppose then that either electrons do not "prepare the way," or that their action is confined to an exceedingly thin layer in the wave front.



Magnet. No Magnet.

Fig. 8.—Explosion-Wave and Reflected Wave crossing the Magnetic Field.

I believe it to be true that we are to-day within measurable distance of arriving at a clear understanding of the temperatures and pressures reached in gaseous combination—an understanding which must be to the advantage of those whose business it is to develop heat and light from gases. But the problems connected with flame are many and intricate. This address has only touched on a few. I have brought these problems before you because I believe in the co-operation of the manufacturer and the man of science.

It has been a sincere pleasure to me to have been connected with this Society, and I hope that some of our relations may be continued now that I lay down the honourable office to which you elected me.

At the close of the address,

Mr. Helps said it gave him great pleasure indeed to propose a hearty vote of thanks to the retiring President. When Professor Dixon came among them twelve months ago, he at once entered into the hearts and minds, and had the good wishes, of every member of the Society; and at all times during the twelve months that he had been their President, they had never called upon his time or assistance to promote the well-being of the Society without he had at once said "Yea." They had had that day his helpful

personality presiding over their business proceedings; they had partaken of his hospitality at afternoon tea; and they had also partaken, through his address, of the great knowledge that he had gained by many years of arduous and persistent work. He (Mr. Helps) was quite sure every member of the Society reciprocated the hope contained in the final paragraph of the address. They did sincerely trust that Professor Dixon's relationship with the Society would continue for very many years; and they were sure that, in the future as in the past, when they asked of him a favour, he would comply if it was to promote the good of the Society.

Mr. J. W. Broadhead, in seconding, remarked that, when the President came to the chair twelve months ago, he had likened himself to the bread part of a sandwich, and suggested that the members were in for a lean year. But it had not been so. They had had a "meaty" year. The retiring President had endeared himself to them all; and they sincerely hoped that, although relegated to the post of a Vice-President, he would come among them whenever it was possible for him to do so. He would always have a hearty welcome. ["Hear, hear."]

The motion was carried by acclamation.

The President said he was much touched by the way the resolution had been put, and by the manner in which the members generally had received it. It had been a most delightful honour to him to have been President during the last twelve months; and he really did feel grateful to the members for the kindness that had been extended towards him. He wanted to say that, to a teacher and a researcher, it was most important that he should be in intimate touch with some, at all events, of the different manufactures carried on in the country; and he hoped sincerely that he had sufficiently won the confidence of the members during the year that they would extend to him and his facilities for looking into their processes with which they felt they might so far trust him. [Laughter.] As a teacher, he thought that one had passed the days when any subject that was perfectly useless was taught as a matter of course. They had arrived at a time when they had to make choice of some subject even in a matter like chemistry. It was impossible to touch it all; and it was desirable that choice should have some practical relation to the lives the students would afterwards lead. ["Hear, hear."] And he saw no reason why in their research laboratories they should not be tackling some problem which had some practical bearing on the manufacturers of the country. For these two reasons, he thought the teacher and the researcher should be in intimate touch with the manufacturer; and he hoped the members would be able to reciprocate this feeling which he so strongly held.

Sir Alfred Keogh, K.C.B., LL.D., Takes the Chair.

The President (proceeding) said he saw, by the phrasing of the next item on the *agenda*, that he was to carry out "the induction" of their new President to the chair; and it was a very pleasing duty. In his distinguished successor, Sir Alfred Keogh, they all recognized a man whom they were delighted to see occupy this position. He (Professor Dixon) had not studied the formal methods of induction since his student days at Oxford. Then he was taught that, when one thing always preceded another thing, the first was the cause of the second. They were taught so. [Laughter.] He felt therefore that in retiring he was working in a good cause, and the effect would live after him, and keep the cause alive. However this might be, they would certainly feel that, in welcoming Sir Alfred to the chair, they were asking a man to come to them who had won the greatest distinctions. If there were sores to heal in their body politic, or if there were wounds inflicted in their competitive warfare, they knew of no man who had proved his capacity on many a stricken field as had Sir Alfred Keogh. He had much pleasure in asking him to take the chair.

Sir Alfred, on taking the chair vacated by Professor Dixon, was received with applause. And, simultaneously, Mr. Helps and Mr. Broadhead (the new Chairman of Council) exchanged seats.

The President said he could not sit down in the Presidential Chair without first of all endeavouring to thank the members for the extreme kindness shown him in inviting him to be their President. He had no claim—no scientific claim—to such a position. He recognized that their kindness was due to the fact that he was the head of a great college [the Imperial College of Science] which had been established especially for the purpose of bringing about the relations between science and industry to which Professor Dixon had just alluded. He (Sir Alfred) had been told by his friends that it was not at all remarkable that the members should have invited him to occupy this position, because the Society, he learned, had been distinguished in the past above all other societies by recognizing this relation between the academy and industry for which his own college had been specifically established. He knew he would find it exceedingly difficult to fill the position in which they had placed him—especially difficult because he followed the distinguished man of science who had just vacated the chair. He was not himself a man of science beyond having had a scientific education; and, after all, though this education was not in the direction which the members of the Society pursued, there was no great difference—there was no difference, he might say, between one department of science and another. Science whether in their direction or his own was really one and the same thing. It was indivisible. Professor Dixon had kindly alluded to him in a manner which was, of course, most flattering. He could only claim that the circumstances of his own career had led him to consider and to study the relation between science, government, and administration generally. Though he was not a scientific man, he thought he could claim that in some respects he was the servant of science. He occupied such a position at this moment. It was his duty; and throughout his life his duty had been to endeavour to get (in his case) the army to recognize that advantage was not taken rapidly enough of advances in modern science—that they were too slow to recognize the growth of science, and how advantageously its lessons might be applied to ordinary common problems. In his own case, the problem he had to deal with was the prevention of disease in peace and war in the nation's great army. If he had done anything in this direction, it was only due to the fact that he had recognized the connection between science and administration which had been too often neglected. This was perhaps why the members had been good enough to elect him their President for the ensuing year. He could not hope to rival his predecessor; but he could endeavour to follow his example. He could at all events claim that he would not yield even to Professor Dixon in doing everything he could to occupy the position in a manner worthy of himself and worthy of the Society.

THE ANNUAL DINNER.

The members and their guests dined together in the adjoining room. To the right-hand side of the President (Sir Alfred Keogh) were: Professor Dixon, Mr. Edward Allen (President of the Institution of Gas Engineers), Mr. W. D. Helps, Mr. R. G. Shadbolt, Mr. F. Templer Depree, Mr. F. W. Goodenough, Mr. H. James Yates, Mr. S. Y. Shoubridge, and Mr. Cyril G. Davis. On the left-hand side of the President were the Chairman of Council (Mr. Broadhead), Mr. Balfour Browne, K.C., Mr. Fred. J. West, Mr. W. E. Price (Hon. Secretary of the Gas Institution), Mr. Thomas Glover (President of the Southern Association), Mr. H. O. Carr (ex-President of the Southern Association), and Mr. Thomas S. Clapham. Among the guests were also noticed Mr. T. A. Guyatt and Mr. Joseph Davis. The vice-chairs were occupied by Mr. F. C. Tilley, Mr. Joseph Taylor, Mr. Percy F. Holmes, Mr. T. V. Miles, and Mr. James W. Wilson. Letters of regret for absence were received from (among others) Sir Corbet Woodall, Mr. Dugald Clerk, D.Sc., Mr. Thomas Newbigging, M.Inst.C.E., Professor Arthur Smithells, Mr. John Bond and Mr. John Young, Vice-Presidents of the Institution of Gas Engineers, Bailie Paxton, the President of the British Commercial Gas Association, and Professor J. W. Cobb, Livesey Professor at Leeds University.

There were only two toasts after dinner.

The President proposed the loyal toast; and it was honoured with heartiness and by singing the National Anthem.

Mr. Broadhead then submitted the toast of "Our Guests." In the course of his remarks he said he was almost inclined to think that had the Society come into existence for no other purpose than to give the members the opportunity of expressing their sentiments towards those who that night honoured them with their presence, it would have been well worth doing. In any case, it was a fitting mark of time at the closing of one annual chapter and the opening of another that they should fraternize, in purely social manner, with those with whom they were so closely allied in the promotion of the great gas industry of this country. They were that night pleased to have with them representative bodies and gentlemen such as the Council of the Institution of Gas Engineers, the Executive of the Committee of the British Commercial Gas Association, with their respective Presidents, Vice-Presidents, and Chairmen, interlocked and dovetailed by the Presidents of the District Gas Associations of the country; and the Society of Gas Industries would like to take this opportunity of acknowledging the untiring efforts of each and all of these organizations in their respective spheres towards a better understanding among the various forces of the industry, with due recognition of the worth and utility of each. The members of the Society of British Gas Industries looked up to the Institution of Gas Engineers as the premier organization and were not unmindful of its resources and initiative in many recent movements with which it had been their privilege as a Society to be associated. Nor did they detract when they paid a passing tribute to the work of the District Associations—designed to meet the technical needs and requirements of a more local character, and who were doubtless oftimes a source of inspiration to the premier body. Likewise the more strictly commercial movement, emanating from among the District Associations and Institutions, and culminating in the creation of the British Commercial Gas Association, of necessity appealed to the whole business instinct of the members of the Society. The British Commercial Gas Association, although only of recent birth, had already done a vast amount of good work; and if supported in the future as it deserved to be, it would undoubtedly help to bring about greatly increased prosperity, not only for gas undertakings, but, as sure as night follows day, also for manufacturers of every description of gas apparatus and appliances.

Mr. Edward Allen (President of the Gas Institution), responding, said the Society of British Gas Industries had gained for itself a place of great respect and usefulness in the gas industry; and it was really marvellous how they had got on before the Society was formed. It was the greatest ally the gas industry had. The respect which now existed would he hoped ever continue. At present the one part of the industry was necessary to the other. In the pioneer days, the gas engineer had to rely on local assistance for manufacturing and distributing plant; but while it brought out his mechanical skill and developed his resourcefulness, the result as to cost and efficiency left much to be desired. To-day the members of the Society were able and very willing to meet all requirements, and out of their special knowledge and large experience to provide plant and machinery for all purposes. Gas engineers highly appreciated, and were grateful for,

the labours that made their professional course so much easier than that of their forerunners. The bond of union was made all the greater by the fact that some of the members of the manufacturing industry (he meant men trained in the ranks of the manufacturers) came over to the gas engineering ranks—young men who had been trained in the works of the manufacturers, and whose knowledge and experience enriched the Institution. Some of the members of the Institution had gone over to the ranks of the manufacturers, and had found a larger field and richer pasture. [Laughter.] These were not so numerous. [Renewed laughter.] There were, however, others who indulged in "excursions" to the country of the manufacturers, and placed at their disposal ideas and devices suggested by their practice as gas makers. It was to be hoped they also found rich pastures and benefited by their enterprise. To-day there was a strong feeling of mutual respect, and a sincere desire to assist each other in every way. The National Gas Exhibition and Congress of 1913 owed its success to their joint efforts, and was characterized by the spirit of harmony and concord. The remarkable growth of the British Commercial Gas Association was explained by the presence of the representatives of the Society on its Committees; and though a scheme for the formation of a Joint Committee which would represent the whole gas industry was for the present in abeyance, the spirit of the movement was alive and was very strongly in evidence.

The remainder of the evening was taken up with a most enjoyable concert, to which contributions were made by Miss Jessie Reeve, Mr. Eric Holmes, Mr. Willie Rouse, Mr. Maurice Charles, and Mr. Lewis Benet.

Before the proceedings terminated the Hon. Secretary (Mr. Cyril G. Davis) and the Secretary (Mr. Arthur L. Griffith) were heartily thanked for their exertions in making such a success of the gathering.

INDUSTRIAL GAS CALORIMETRY.

The current number of the "Journal of the Franklin Institute" contains the following abstract, by Messrs. C. W. Waidner and E. F. Mueller, of a Technological Paper on the above-named subject issued by the United States Bureau of Standards.

After an outline of the object of the investigation, precise definitions of the heat units and of the several heats of combustion are considered. Reference is made to the more important types of calorimeters which have been applied to the measurement of the heating values of gases, and then the principle of the flow calorimeter is set forth, and an example given showing the reductions of, and corrections to, the observed data that are required in order to find the total and net heating values.

The results of an experimental investigation of laboratory gas-meters, showing the errors to which such meters are liable, the precautions to be observed, and the accuracy attainable in their use, are given at length. It is shown that an accuracy of about 0·2 per cent. may be attained if the meter is calibrated *in situ* at the time of use, and that the calibration may be reproduced from time to time, by making suitable adjustments, to an accuracy of about 0·5 per cent.

The results are given of an extended series of investigations of the various factors that may affect the accuracy of heating-value determinations with flow calorimeters, such as completeness of combustion, accuracy of temperature measurements, magnitudes of the various heat losses from the calorimeter, particularly as affected by the volume of the entering air and of the products of combustion and by the atmospheric humidity, and the accuracy of measurements of the quantities of water and of gas. The effects of certain other factors, which depend on the nature of the gas tested and are particularly noticeable in the testing of illuminating gas, are briefly considered.

The results are given of an extended series of experiments with natural gas and with nearly pure hydrogen. These show that, when the necessary corrections for losses of heat from the surface, for the effect of atmospheric humidity, &c., were applied to the observed heating values obtained with flow calorimeters of suitable design and construction, the total heating values thus found were in agreement to about 0·3 per cent. with the total heating value obtained with calorimeters of the Berthelot bomb type, provided due allowance was made for the difference between the heat of combustion at constant pressure and at constant volume. The results obtained with illuminating gas indicated that the heating values obtained with the Berthelot bomb type of calorimeter were probably in error—being too low (about 1 per cent.); but further investigation will be required to determine the cause of the discrepancy found. The summarized results are given of a critical investigation of eight flow calorimeters, representing types widely used in America or abroad, and of one calorimeter of the comparison type.

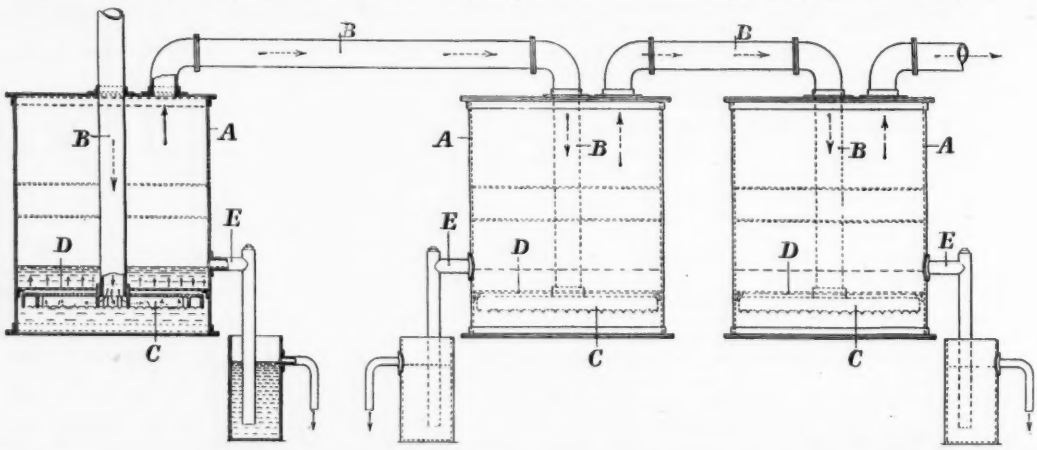
The investigation has shown that several of the calorimeters that were investigated could be used, when proper precautions were observed and suitable corrections were applied to the observed heating values obtained with them, to determine the total heating values of most kinds of gases to an accuracy of about 0·3 per cent. Some of the calorimeters are, however, subject to constant errors that cannot be eliminated or be readily determined except by comparison with a standard instrument, such errors for one calorimeter amounting to nearly 2 per cent.

Examination of a very large amount of data obtained during the investigation indicates that, with those calorimeters which are free from significant constant errors, total heating values should be determinable, under conditions obtaining in the practical testing of gas, to an accuracy of the order of 1 per cent.

REMOVING HOT TAR FROM GAS.

The Berlin Anhaltische Maschinensbau Actien-Gesellschaft have taken out a French patent [No. 461,956 of 1913] for a process and apparatus for removing tar while hot from gas, and utilizing as washing materials the tar, tar oils, and other products, to obtain sulphate of ammonia, extract naphthalene, &c.

In the present arrangements for purification, the gas passes through screens, which divide it up, and the bubbles undergo compression, the effect of which is to agitate the surface of the washing liquid, and destroy its tension. The object of the patentees' invention is to obviate this, and keep the surface as calm as possible; and the form of apparatus they employ is shown in the accompanying illustration. Owing to the large volume of gas to be treated for the removal of the tar, it is advisable to place several appliances side by side. The gas is conveyed to the washers A through the pipes B, and first reaches the distributors C, which dip into the washing liquid. Above them is a sieve D, which also dips into the liquid. The meshes of the sieve are sufficiently large to avoid clogging or obstruction by the tar; a mesh 0·4 inch square being found sufficient. The effect of the sieves is to keep the surface of the liquid calm, while the level is maintained constant by the overflow-pipe E.



Yorkshire Junior Gas Association.—Next Saturday the Association will meet in the Fuel Department at the Leeds University to hear a paper by Mr. S. B. Johnson, of Hull, on "Electricity Notes and Experiences."

Masonic.—At last Thursday's meeting of the Murdoch Lodge, No. 3480, held at the Imperial Hotel, Temple Street, Birmingham, the W.M., W. Bro. Vincent Hughes, P.M. 2582 (Staffs.), installed W. Bro. Alfred T. Harris, P.M. 1330, P.P.G.P., Leicestershire, as his successor in the chair.

Experiments with Mixed Fertilizers.—In a recent number of the "Journal of Industrial and Engineering Chemistry" [Vol. V., p. 933], Mr. R. N. Brackett stated that laboratory experiments and experience on a factory scale both show that in mixed fertilizers containing one part of calcium cyanamide to 6·25 or 8·33 parts of acid phosphate (superphosphate), with or without "ammoniates" and potash salts, there is on standing a gradual increase of the insoluble and a decrease of the available phosphoric acid.

MUNICIPAL GAS AUTHORITIES AND THEIR CUSTOMERS.

By Robert Watson, of Doncaster.

[A Paper read before the District Conference of the British Commercial Gas Association at Bradford. March 17.]

According to the latest available Board of Trade returns, there are 822 statutory gas undertakings in the United Kingdom supplying gas to some 6,650,000 users. Of these, 302 are owned by local authorities, who have thus assumed the responsibility of catering for the needs of 2,744,000 consumers. The numbers are such as to render the question as to the relationship existing between municipal gas authorities and the gas-using public of great importance, and particularly in the area known briefly as the Manchester District, but which covers Lancashire and Yorkshire and the more immediately adjoining counties. Some 50 per cent. of the local authorities subscribing to the British Commercial Gas Association are situated in the district, and are represented to-day at this conference. No apology is, therefore, necessary in introducing topics which may appear primarily to concern them—especially as the subject of gas supply to consumers is one in which we are all keenly interested, and can be helped by hints and suggestions from company and municipal representatives alike.

Results of Company and Municipal Administration.

"Progress" has from the start been the watchword of the British Commercial Gas Association, interpreted in a wide sense, meaning not only additional business from new customers and the introduction and use of gas in fresh fields, but the ever-important duty of securing and maintaining the satisfaction of consumers generally. The latter is made a creditable part of the Association's work, even if it be dictated by motives of ultimate gain. The "Transactions" and "Bulletin" issues of the British Commercial Gas Association, though its career has been short have afforded excellent and instructive examples of the way in which individual gas undertakings have locally kept the watchword in mind. The fact, however, that these examples have mainly been furnished by company rather than by municipal gas undertakings seems to indicate that the latter—not being quite in the same happy unrestricted position to "command success" as their colleagues—are unable to give so good an account of progress as their administrators and managers would undoubtedly like.

To those of us who have had experience of both company and municipal gas undertakings, this is not surprising, since the conditions of work are in many respects dissimilar. That there are differences is confirmed by the Board of Trade returns for the United Kingdom. If a comparison be made of the rate of increase in gas sales between companies and local authorities, as disclosed by the last published statistics, we get the following figures:—

Period.	Rate of Increase in Gas Sold. Company.	Local Authority.
Ten years to 1911 . . .	33·1 per cent.	27·9 per cent.
Five years to 1911 . . .	13·5 ,,	12·6 ,,
One year (1911)	3·6 ,,	3·0 ,,

From which it is evident that companies stand first as regards growth of business.

The same returns afford other, and perhaps more illuminating, information in the fact that the annual gas sale per company consumer is 30,600 cubic feet, and 5300 cubic feet greater than that of the municipal gas user, whose average is only 25,300 cubic feet. There has always been, and is still, a considerable difference in the average gas usage of the two classes of consumers. No particular reason exists why they should not be approximately alike; and recent figures tend to prove that they can be made so. The figures of the provincial corporation and company gas undertakings referred to in "Field's Analyses" have been taken for the last six years dealt with, and the total gas sold worked out per consumer in the same way as the totals of the Board of Trade returns. Investigation shows that, while the average gas sales per consumer had, through probably the introduction of the prepayment meter, been falling for some time, the averages became constant during the three years following 1909, and were about 28,500 cubic feet per municipal consumer and 34,150 cubic feet per company user.

The general average for the corporation gas undertakings for the subsequent year 1912-13 shows a marked rise to 29,390 cubic feet; and it should be noted that the individual averages—several over 1000 cubic feet—producing this increase are those of municipal gas authorities who have adopted progressive methods. The corresponding average figure for the company year 1913 has still to be obtained; but seeing that these undertakings have probably for years been enterprising in their business tactics, their work of increasing sales per customer is necessarily more difficult. In one or two individual cases where 1913 figures have been published, this happy result has, however, been achieved. There cannot be the slightest doubt that the gratifying improvement thus indicated is due to the propaganda work of the British Commercial Gas Association, and consequent stimulated local activity.

This comparison refers to consumers whose interests in the way of efficient gas usage may or may not, according to circumstances, be under any special care exercised by the undertaking. It is useful to note that, where direct control is possible, as in the case of public lamps served by local authorities, a different tale is told. Municipal gas authorities are evidently cognizant of the usefulness and economy of gas for street illumination, since the 1911 returns show that they use 24·7 gas lamps per mile of main, compared with 16·5 in company areas, where more often than not the electricity supply is in the hands of the local authority, and is its only love.

In thus making comparison between the results o company and municipal administration, there is no intention or wish to discuss the merits or demerits of either method of control. It is within the power of both to give effective service to the public, and the desire to help in doing this in the case of municipal gas supply is a sufficient reason for adducing figures which may indicate openings for progress and hope for enlarged fields of custom.

Raising the Consumption per Municipal Gas Consumer.

The mere possibility of an additional sale of 5300 cubic feet a year to each of our existent gas users, obviously gives ground for thought. There at once arises the question whether, from the point of view of the municipality, the monetary return obtained on the capital invested in the undertaking is as great as it might be—a matter important to the ratepayer if the concern is regarded as a money earner, and to the public generally if a cheap supply of gas is, as it should be, a *desideratum*. Then, on the face of it, the relatively low gas usage per consumer seems to suggest either that the customers of municipal gas authorities have not had the fullest opportunity of knowing to what varied and economical uses gas can be put, or that many of them are so indifferently served that they are discouraged from making greater use of gas.

In view of the revelations of the Board of Trade returns, it can be easily understood that, while all are anxious for additional gas output, those representing municipal gas authorities probably thirst for the extra sale of 5300 cubic feet per consumer. An addition of this amount represents 20 per cent. increased sale; and as it is suppliable through existent mains, services, and meters, and without appreciably inflating the standing and administrative charges, it provides enhanced profit which, multiplied by the total number of consumers, may well reach a substantial figure—helpful to the public, as a whole, whether considered *quâ* consumer or ratepayer.

In the interest of municipal gas authorities, and certainly of their customers whose gas might, by reason of the consequent greater magnitude of the undertaking, be cheaper, it becomes a duty to find ways and means of raising the gas usage of the average consumer to at least the figure achieved by other gas undertakings. It is the more desirable, because work to this end must also materially help in gaining fresh custom, thus increasing the percentage gains. The question as to how this is to be done under the handicap of the more or less restricted conditions characteristic of most municipal gas authority working, is one well worth discussion.

While the closest race with practically equal advantages can take place between company and municipal undertakings in matters of gas manufacture and distribution, the contest for "pride of place" becomes unequal when on commercial ground, since absolute freedom in business enterprise is more or less impossible for municipal gas committees and their managers. There are several interests which have ever to be considered—such, perhaps, as the interference, actual or possible, with the business of local plumbing and fitting firms; the exigencies of an electricity department in which capital has been invested, and for which, therefore, custom must be found; or the desire to leave people to make their own choice of two public services, in order to avoid possible prejudicial competition between departments. That municipal gas authorities are handicapped in one way or another is not disputed; and any reasonable method of surmounting the obstacles blocking progress would be very heartily welcomed. There can be no doubt that the members of town councils generally—even if some are keen on using profits in relief of rates—are anxious to afford their constituents a cheap and efficient supply of gas; and the fact that the greater the use of this fuel by their townspeople the less the vitiation of the atmosphere by smoke, should quicken their desire.

While, however, municipal gas undertakings are by no means unprosperous, it must be admitted that companies owe their greater and surprising success to methods not usually employed by local authorities. These methods may be briefly enumerated. The cultivation of close relationship with customers, frequent advertising and canvass of the district, the employment of a showroom in which to display modern gas appliances, readiness to undertake any fitting work required, the constant care that gas is consumed efficiently, and the establishment of maintenance systems as adjuncts to their business. Some companies go much farther; and we hear of complete records of the piping and appliances fitted in every house made in the undertaking's books. It is true that some corporation gas undertakings adopt in part similar means—undertaking fitting work in common with local firms, and keeping a staff of men for maintenance work. But it is very doubtful whether any are allowed to go as far as the more

progressive gas companies in the supply of gas appliances at low prices, and free maintenance of the apparatus fixed. It is pretty safe to say that under all ordinary circumstances gas is simply supplied to consumers' meters, and its ultimate usage, through altruistic motives, is left more or less to chance.

This may have been all very well in the days when the use of gas was a comparatively simple matter—as for instance, through flat-flame burners, and other appliances requiring no air adjustments. The present possibility, however, of utilizing much more fully the heat units possessed by gas, has so changed the character of supply, and placed within the reach of the consumers so much greater efficiency and economy, that the duty of gas undertakings to-day should by no means cease at the meter. This would seem to be especially the case in view of the fact that the development of gas light, heat, and power takes place in two stages—one being the manufacture of the gas at the works, and the other the accurate blending of air with the gas when burnt on the consumer's premises. The importance of the latter is such that rationally the suppliers should, in the interests of their customers, have some sort of oversight as to the method of its usage. This does not necessarily imply the assumption of fitting work, but should at least carry with it some right to impose for the gas-fitting trade a specification of requirements as to size, character, and use of both pipes and appliances.

Under existing conditions, there is little or no opportunity of knowing whether gas is employed efficiently or otherwise. The periodical visits of meter readers are obviously too hurried at the quarter-end to permit of any information being obtained. The absence of the knowledge is the more unfortunate because, although the majority may be satisfied, there are many cases where assistance would be welcomed—even by people who are wont, in consequence of bad service, to look upon gas as a "necessary evil," rather than a blessing. Not a few suffering gas consumers put up with what they have got in the partial belief that there is no remedy—notwithstanding sometimes the evidence of a well-lighted house next door. Some complain to neighbours, others to councillors; and I am inclined to believe at times that very few dream of writing direct to the gas offices, in spite of the invitation to do so printed on the gas accounts.

It seems unnecessary to instance the sort of trouble some consumers, not knowing better, experience from small or badly laid pipes, defective or dirty burners, ill-fitted fires, inadequate air adjustments, and the like. If any examples were wanted, they could be produced in hundreds by most gas engineers. A few photographs will suffice. They are interesting because, although every available opportunity is taken to anticipate complaints, these are of defects brought to notice by chance remarks—the consumers having suffered for some time without attempting to approach the Gas Department. [See Appendix.] These facts all go to prove the supreme necessity of getting into close and regular touch with gas users, and the advisability of adopting any method which will facilitate and render this possible. It is, however, exceedingly difficult, and frequently purposeless, to institute periodical calls in order to ensure satisfactory service, without being at the same time prepared to undertake necessary work. Consumers may be told to go to their ordinary ironmonger or fitter; but they either put the matter off or, if they go, may get something other than that advised. There is, too, the risk of cheap and inefficient work being done. Fitting firms, especially in the latter case, usually object to inspection of work; and there is at once trouble brewing for the gas department.

Some municipal gas authorities have show-rooms connected with their town office, thus affording opportunities for exhibiting modern appliances and demonstrating efficient gas usage. But it is a question whether it gives sufficient chance for real good unless the gas authority also contract for the fitting work, which opens the way for domiciliary visits. Although parliamentary power is given to most English corporation gas authorities to undertake the fixing as well as the sale and hire of all gas fittings and piping, it is not often used, and the work is left to local plumbing and fitting firms. Consumers are not likely to visit or to buy at a show room if they have to arrange elsewhere for the fitting work; and from the undertaking's point of view, this in itself is unsatisfactory, since, without ample outlets, the show stock must in part be renewed by the scrapping method, or else remain out of date.

Benefit of the British Commercial Gas Association.

In view of the various obstacles to municipal gas progress, one welcomed with considerable satisfaction the formation of the British Commercial Gas Association, because it was patent that where corporation gas engineers were hampered in the work of pushing gas locally, a gas propaganda scheme, covering the whole country and carried on through papers and magazines read by the general public, was calculated to reach consumers in a way which existent conditions precluded. Gas users were likely to get useful facts from their fireside reading, and thus realize that gas had possibilities greater probably than they had ever imagined. If their service was inefficient, there was, too, the chance that their acquired knowledge might lead them to consult more freely the officials of their local gas undertaking. One is inclined to think, too, that the Association work in so many directions is also likely to benefit gas-fitting firms generally, since with a public better informed in the matters of gas usage, further business is bound to accrue to them. I believe, therefore, that municipal gas authorities, in supporting the British Commercial Gas Association, have done a very wise thing in the interests of customers, as well as of their own prosperity.

Municipal Gas Undertakings and Trading Firms.

With such propaganda work done nationally, the way is more and more prepared for local enterprise. Corporation gas departments have, however, been somewhat handicapped in work of this kind in consequence of the opposition of gas-fitting firms, and of others who object to anything which savours of municipal trading. I am not proposing to discuss the latter question; but it must be admitted that any such check is unfortunate, since it seriously affects progress. The attitude is, of course, understandable, but not altogether justified, as publicity work and the assumption of a certain amount of fitting work by a gas department on (say) equal grounds as to prices, does not necessarily injure, and, indeed, is more likely to increase, business for all those firms who choose to take advantage of the gas undertaking's enterprise.

A gas department, with no plumbing, electrical, or ironmongery interests, is best able to keep gas users *au courant* with the later gas developments and appliances; and stimulated interest is bound to result in orders. This has been the case in various branches of the gas industry. The original introduction of incandescent lighting in many districts was due to the work of gas undertakings; and the same can be said of later types of lamps and burners, of gas-fires, of gas-steam radiators, and the like. As a result of pioneer work in fitting these appliances, considerable business in all branches has accrued and gravitated to private firms.

Though there are municipal gas authorities who "pursue the even tenor of their way" without reference to trading interests, many departments have been obliged, either in consequence of municipal trading objections, or in deference to the wishes of gas-fitting firms, to find some *via media*. Attempts have been made to institute working agreements between the two parties; and this has been done with more or less success. It would appear, in fact, that the best hope for municipal gas authorities is in this direction, assuming their hands are not tied altogether. Some such arrangements frequently allow the gas authority to look out for and solicit business of all kinds, but leave the customer free to decide whether the fitting should be effected by the department or by an approved gas-fitting firm—the charges being in accordance with a mutually agreed scale.

Under other schemes, the gas department do no work (other than meter and cooker fixing), leaving ordinary fitting business to the trade, but undertaking simple hire or hire-purchase of apparatus. If an order is obtained for a gas-fire under these terms, the work of fixing is done by a local firm, who are paid by the department at schedule prices, assuming satisfactory completion. In most cases the department retain the right to undertake the periodical maintenance of incandescent burners, fires, and the like. Fitting firms are pecuniarily encouraged to act as agents for the gas authority, and are expected to have some display of gas appliances in their windows. Where a gas department possess a show-room, the trader is invited to take customers and sell goods from the stock in hand, buying the same from the gas department at practically cost price.

The Case of Doncaster.

So far as the supply of gas-fires and like appliances is concerned, an arrangement somewhat on the lines of the second case was made with the fitting trade in Doncaster; and this is working satisfactorily. The scheme was keenly opposed when first suggested; but, after several joint meetings and explanations, it was unanimously accepted. The objections were due to the fear that, in consequence of the sale or hire-purchase of appliances by the gas department, consumers would deal direct with the undertaking, and local tradesmen lose what business of this kind they happened to have. As a matter of fact, in the case of many of the gas-fitters now doing work for the department, this business was *nil*, and no great attempt had been made to get it. [The general terms of the agreement are indicated in the specification and schedule included in the Appendix.]

The scheme was thoroughly advertised by the Gas Department; and the results have been distinctly encouraging. The fitting firms are satisfied with its working, since they have not only obtained additional work in the way of fixing for the gas department, but, as a direct result of the advertising work, have materially increased their own sales of gas-heating appliances. The system obviously avoids the stocking of (say) gas-fires by tradesmen; and they are saved expense in the way of capital, obsolescence of goods, bad debts, and the like. Further, the method, as one firm told me, lessens unprofitable cutting of prices as between themselves, and particularly protects them from the unfair competition of inefficient fitters. The latter is a point for gas undertakings, since many are the difficulties caused by scamped work resulting from cut-prices.

The arrangement has certainly increased the good feeling already existent between them and the Gas Department. One hopes that the extension of the principle in a more comprehensive specification, coupled with some freedom in action, will now become more easily possible, and that the Gas Department will thus be able to employ a district inspector and canvasser able to take orders for any and every thing. We have recently started house-to-house canvassing for the purpose of stimulating coke usage; and I see no reason why the method should not be extended to all phases of the Gas Department's work.

It is to be hoped that gas-fitting firms generally will see their

way to work amicably with the gas undertakings whose administrators, in view of public objections to municipal trading, are disposed to meet them on grounds which do not prejudice the interests of their customers.

Training of Gas-Fitters.

The recent proposals of the Manchester District Institution of Gas Engineers to establish classes in various centres for the training and ultimate certification of working gas-fitters, should help both the gas industry and the trade. The suggestions have been jointly discussed by gas engineers, master plumbers, and gas-fitters, and (with modifications) adopted by the Institution of Gas Engineers and the City and Guilds of London Institute. The reasons for the proposal may be briefly recounted.

Gas-fitting has hitherto been regarded by many as comparatively unimportant work—good enough for poor plumbers or apprentices, as was stated at one meeting by a representative of the Operative Plumbers' Association. Even cycle agents and pipe-fitters consider themselves competent to undertake the work; and there is nothing to prevent them. So far as plumbers are concerned, the only gas-fitting knowledge required of them by the City and Guilds of London Institute syllabus, in view of examination, is covered by a direction to study the "movement of air or gas through pipes, as in the distribution of coal gas, the elasticity of gases, and the principle of the bunsen burner;" and of pipe work as applied to "hot and cold water supplies, waste pipes, &c."—gas-piping not being included. There are no other references in the syllabus to our work; and although the "general principles of conduction, convection, and radiation" are alluded to, in connection with hot-water supply and appliances, not a word is mentioned as to gas heating.

Gas-fitters, as a class, do not, properly speaking, exist; and it is for the purpose of putting them on a better footing for their own advantage, as well as in the important interests of gas undertakings, that opportunities for better training are to be afforded. There is ample room for skilled and qualified gas-fitters, ranking in all respects with certified plumbers, since the field of work is rapidly enlarging, and is of a character which has long been outside that of mere pipe work. Some important conferences have taken place with representatives of the Ironmongers' Federated Association, the Institute of Plumbers, the Operative Plumbers' Association, the Birmingham Master Gas-Fitters' Association, and others; and though plumbers have not been encouraging, ironmongers and master fitters generally favour the scheme.

The City ond Guilds of London Institute have agreed to include in their programme a distinct syllabus and course for gas-fitters. Centres are to be established wherever possible for classes and examinations; and all the arrangements will be in the hands of representatives of local gas undertakings, working jointly with master gas-fitters. The ultimate result should be the evolution of a class of skilled men, and an improvement in all gas-fitting work done.

It is hoped that administrators of gas undertakings—corporation and company alike—will see their way to assist the scheme. both by their influence and their help, so far as the small expenses are concerned. The furtherance of good working arrangements with the local firms wherever possible, and the enlistment of their sympathy and help in the training of the rising generation of gas fitters, at a time when gas undertakings, through the British Commercial Gas Association, are doing their best to educate the general public as to the still-increasing possibilities of gas usage, should be of particular service to municipal gas authorities.

Through the non-clashing of interests and with resultant freedom of action, gas authorities should be in a better position to see that their customers get good service out of the gas used. They will also be able to keep them advised as to new and improved apparatus, and to indicate the potentialities of gas usage, the real extent of which is so little known to the public, strange as it may seem. Possessing gas capable (even at 2s. 1d. per 1000 feet) of furnishing, as Mr. Edward Allen stated in his address last autumn, 2400 candle light per hour for 1d., and heat equal to 22,000 B.Th.U. at the same price, municipal gas authorities should be in the same free position as companies to tell and demonstrate to their customers how they can help themselves in the way of economy and efficiency.

I doubt whether many of the larger gas users are really cognizant for instance of the value of high-pressure gas for lighting. The habit of periodical calls would lessen the chance of this ignorance; and the acquaintance with the internal arrangements of customers' premises, and even of processes in operation there, would place the staff in a better position to proffer advice. The same thing applies to the very important and extending field for industrial gas usage. The possibilities of custom here are probably beyond present conception, but were ably indicated by Mr. H. M. Thornton in his British Commercial Gas Association paper last year. It is satisfactory to know, from a recent return made of gas undertakings connected with the Yorkshire Commercial Section, that there is a growing tendency to give special prices for gas so used in quantity. It is a right step. A low price is justified because the custom is generally in the daytime, and taken more or less equally throughout the year.

Differential Prices.

It is already the practice to give such terms to gas-engine users and for similar reasons. While in the industrial field the undertaking can push business freely because local firms do not, as a rule, deal in this class of work, there is difficulty in some towns with regard to engine custom, in consequence of the consideration given to electricity departments. There are times when the gas department could offer gas at a low, yet remunerative, price where used in quantity during daylight hours throughout the year; but this is not always done because gas, judged in brake horse power, is already the cheaper of the two, and electricity would be at a disadvantage. The method of reducing this disability is usually by relieving the day electric user, so far as price is concerned, from standing charges, either in full or in part. The arguments used in favour of "cut prices" for day customers equally applied to gas supply in the past when lighting was the only load, and in view of the relatively high capital charges for holder storage may be said to some extent to apply at the present time. But it is certain that no gas undertakings have ever gone so far as to allow a power consumer to take a supply at about one-third of the price charged to a lighting consumer. It is not the intention, however, to discuss the question of competition between two departments belonging to the same municipality, because this body has the power to keep the balance even.

There are still many chances for gas business in competition with suction gas and small steam units. With gas at (say) 1s. 6d. to 1s. 9d. per 1000 cubic feet, there can be little doubt that it does not pay manufacturers to incur the cost of a suction gas plant under 100 B.H.P. But here, as against steam and various industrial fuels, the gas department requires scope to negotiate, unaffected by other interests, with a relatively low, although still remunerative, gas price. All such gas usage, displacing coal, may help materially in the diminution of the smoke trouble; and this is of service to the community at large, as well as to the gas department in increasing output.

In many ways the possibilities of gas undertakings are great; but realization is principally in the hands of those who seek for it, and it is this fact which invites discussion as to ways and means of achievement.

APPENDIX.

ABSTRACTED CLAUSES FROM SPECIFICATION OF WORK AND SCHEDULE OF PRICES REFERRED TO.

Orders obtained by the Gas Department.

Where orders are obtained by the Gas Department or their agents, the gas consumer will be asked to select his tradesman from the list of approved gas-fitting firms who have accepted this specification and schedule of prices. Formal notification of the work to be done will be sent in writing to the selected firm (hereinafter called the contractors); and the latter will be required to obtain from the Gas Department the gas fire, heater, or other appliance ordered, and fix same within eight days from delivery of same to them.

In the case of new orders for any fire, &c., to be fixed on hire-purchase or similar terms, the Gas Committee will pay to the contractors a bonus equal to 4 per cent. of the list price of the fire or other appliance fixed, in addition to the charges for fixing. Where the order obtained by the Gas Department is for a fire or other apparatus to be bought outright by the customer, the Gas Committee will hand same over to the fitting firm selected by the purchaser at the current list price, less the ordinary trade discount. The gas-fitting firm will in that case deal direct with the customer; it being understood, however, that the work shall be done generally to the specification, and in accordance with the schedule of prices. The Gas Committee reserve the right in all cases where they have obtained orders to satisfy themselves by inspection that their customers' requirements have been met.

Orders obtained by Local Gas-Fitting Firm.

Where a *bona-fide* order for any fire to be fixed on hire purchase terms is obtained by the contractors on behalf of the Gas Department, the Committee will accept the order as if obtained by their representatives, and deal with it as above. The gas-fires or other appliances will be supplied by the Gas Department; but the bonus in this case will be increased to 6 per cent. of the list price of same.

The bonus in either case to apply only to new custom, and not to changes.

Make of Fire.

The Gas Committee will from time to time advise all contractors of the makes and types of fires, heaters, and other appliances which they will supply under the scheme. They will, as far as possible, provide advertisements, lists of the fires, &c., used, and probably loan specimen fires, &c., to the contractors for window display.

Workmanship and Material.—Work to be done.—Sizes and Weight of Pipe.

Clauses follow as to workmanship and material, work to be done, and sizes and weight of pipe.

Schedule of Prices.

The prices to be charged for fixing gas fires, heaters, and the like, and making good, &c., in accordance with the specification are as follows:—

Fixing fire and providing and fixing 2 feet polished brass or copper pipe and tap, with ½-inch compo pipe not exceeding 5 feet in length. (If tap is not provided, a deduction of 1s. for same to be made)	6	0
Ditto Ditto with ½-inch compo pipe not exceeding 10 feet in length	8	0
Ditto Ditto with ½-inch compo pipe not exceeding 15 feet in length	10	6
Extra per foot run for additional ½-inch compo pipe, labour, making good, &c.	0	4
Extra for flue-pipe and sheet-iron back (22 gauge), if required—latter painted two coats best black stove enamel	1	9
Extra for cap for flue-pipe (if required)	0	6

Extra for additional flue-pipe up chimney (if required) at per foot run	0	6
Extra for elbow for same (if required)	1	0
Extra per foot run to be added if ⅝-inch compo pipe used	0	1
Extra per foot run to be added if ¾-inch compo pipe used	0	2
In cases of changes of fires where only time and brass piping are required	3	0

Lead water-pipe ½-in. (5 lbs. per yd.) piping only.	1s. 6d. per yd.
Do. ⅝-in. (6 lbs. do.) do.	1s. 9d. do.
Do. ¾-in. (7 lbs. do.) do.	2s. 0d. do.
Do. 1-in. (10 lbs. do.) do.	2s. 6d. do.
Wiped joints ½ in. and ⅝ in.	9d. each.
Do. ¾ in. and 1 in.	1s. 0d. each.

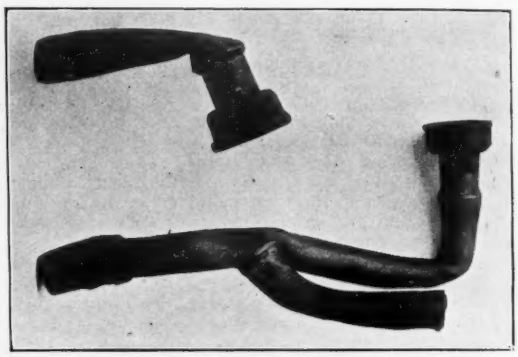
Labour on water-piping to be charged separately at 10d. per hour.

Where gas-fires, &c., are sold for cash, a discount of 10 per cent. is to be allowed off the current list price of same.

[Note.—"Current list price" means the list price *plus* any advance that may be obtaining at the time.]

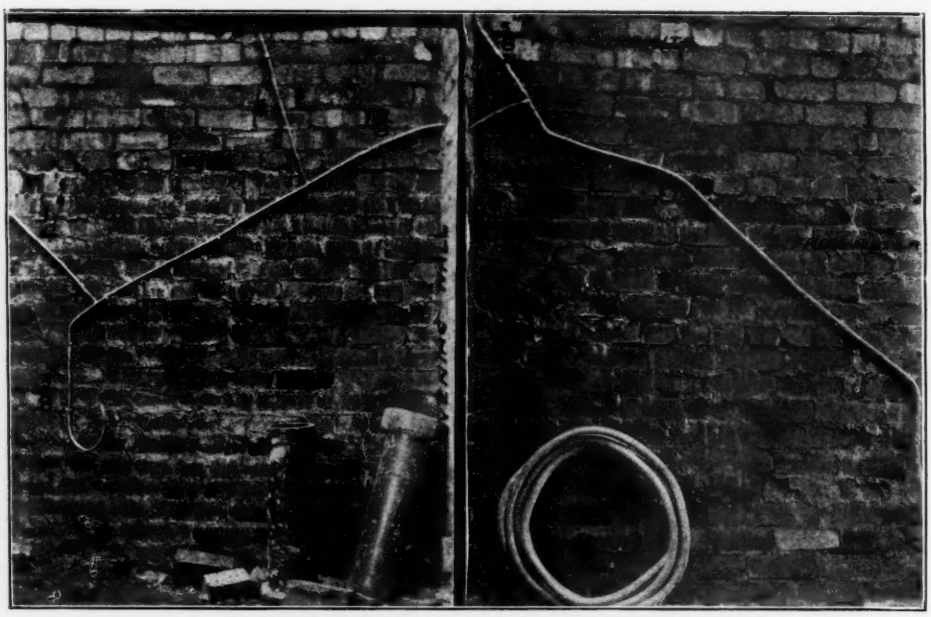
Completion of Work—Accounts.—Delay in Execution of Work.

The remainder of the specification deals with the completion of work, accounts, and delay in execution of work.

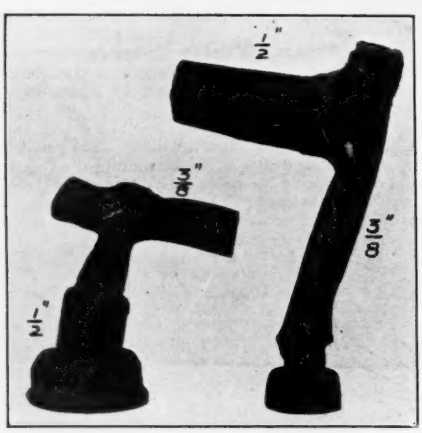


Causes of Poor Lighting.

PHOTOGRAPHS OF INEFFICIENT FITTING WORK.



GAS-FITTING BY A CERTIFIED PLUMBER.



Reasons for a Defective Supply to Gas-Fires.
Half-Inch Feeds off Three-Eighth Inch Pipes.

DISCUSSION.

Mr. E. A. Harman (Huddersfield) moved a vote of thanks to Mr. Watson for his paper. They had anticipated they would have a very profitable paper; and he was sure that none of them had been disappointed. It appeared to him, however, that the table showing the results of municipal gas undertakings was somewhat misleading. He thought, indeed, that the word "municipal" might almost have been obliterated from the title of the paper, because so many of the points were applicable to all undertakings alike. One point he appreciated very much was with respect to complaints. One heard of cases in which injustice was alleged; and upon going to ascertain what it was all about, they found it resulted from a penny being fast in the meter, or some other equally trivial cause. But the complaint perhaps had already travelled around by some circumlocutory method, instead of going direct to the gas office. If only complaints were to go to the gas offices in the first instance, much trouble and difficulty would be saved. As there were many municipal representatives present, and the paper aimed at dealing more particularly with municipal matters, might he suggest that, in cases where a complaint reached (say) the chairman or deputy-chairman of a municipal gas undertaking, if the inquiry were directed to the gas-works officials a great deal of trouble and annoyance would be saved. The paper showed much labour and care, and he was sure they would all read it with great profit and interest later on.

Mr. Councillor F. J. West (Manchester) seconded the vote of thanks. Mr. Watson from the first had shown great interest in the affairs of the Association, and had from time to time contributed much useful information. Generally speaking, the paper was an excellent supplement to the ideas of Alderman Phillips [*ante*, p. 803], and contained sound business progressive methods as applied to the sale of the commodity which was a necessity to every member of the community. He (Mr. West) thought a great deal of the recent success of the gas industry was due to the enterprise of the Association. To-day there was great need for the expansion of the Association. One continually met with expressions, by those they would think to be intelligent people, suggesting that the gas industry was a decaying industry. He had been many a time sympathized with by friends for being in an industry that was going "spark out;" and he liked to come across these particular men, so as to have an opportunity of explaining what the position of gas really was, as indicated by gas shares, which were gilt-edged securities, and the fact that, generally speaking, gas undertakings were the most prosperous undertakings in the whole country. If the paper did nothing else than advertise and extend the usefulness of the Association, they would be more than pleased.

Mr. Charles Wood considered the paper by Mr. Watson was full of points, but he should like to confine himself to the remarks about working in harmony with plumbers and gas-fitters, because this was a matter which was very important to them in Bradford at the present time. They were about to open new show-rooms in Bradford, and were faced with some opposition from the plumbers and gas-fitters. These men had not done much gas-fitting in the past; and all that the Bradford Corporation wanted to do was to show them what could be done with gas. He was quite

sure that, when the plumbers and gas-fitters of the city really understood the position, they would see that, instead of having their business decreased, it would be increased; there could be no doubt whatever about that. The Corporation were not wishing to do anything that they had not done before; all they wanted was to bring their goods before the public and show everybody what could be done. He was glad to hear that the system of co-operation between the Doncaster Gas Department and the gas-fitters worked so well. He was afraid that this was not the case in some other towns; but there were members present who could speak much better upon this point than he could. They had not had much to do with the training of gas-fitters in Bradford. As to differential prices, it was only nine months since they began to differentiate between price of gas for power purposes and for ordinary consumers; and they had now got so far as to reduce the price of gas to large consumers with gas-engines down to the low figure of 1s. 3¾d. It had, however, yet to be seen with what degree of success. He could only add his thanks to Mr. Watson for his paper, which would be well worth studying by all of them.

Mr. S. Meunier (Stockport) said Mr. Wood had struck a most important point with regard to arrangements which had been made, or might be made, in advancing their business in relation to gas-fitters. Their experience at Stockport had been a very bad one indeed. For the last eight or ten years they had periodically had this matter under consideration, and they had also had meetings with the various local plumbers and gas-fitters; and in every case they had been met with a very determined statement that the Corporation had no right to undertake gas-fitting of any kind, or even to supply gas apparatus. Of course they had been supplying gas apparatus for a great many years, and up to now they had done their own fitting-up of stoves, &c. The Gas Committee had been extremely anxious all these years to try and evolve some line of policy which would be good for the department, for the plumbers and fitters, and for the consumers; but so far they had never been able to arrive at anything except that the plumbers and gas-fitters wanted a price which would at once have militated against the expansion of the business, and would at the same time have cost the consumer a great deal too much money for the apparatus. In regard to differential prices for gas, he was rather surprised that Bradford had only just taken this matter up. They in Stockport had long had differential prices—not on orthodox lines exactly, but in the form of differential discounts on the basis of something on the lines of their electrical friends in regard to long-hour loads. It had been of extreme benefit not only to the consumers but also to the department, because it had increased very largely the sales of the department for industrial purposes. When he told them that they even carried the principle of differential prices to the little fried fish and chipped potato shops, they would realize that Stockport had extended the principle to a pretty large extent. They had, of course, very heavy consumers as well; but it was always felt that before they could undertake anything of this kind they should fully consider the requirements of those on quite a small scale, and particularly that any gas which was used in the manufacture of any article which was to be sold was entitled to the differential discount basis upon the power rate. The question of the education of gas-fitters, which Mr. Watson had had a great deal at heart, was a most important matter if they were to increase their sales, and above all, to satisfy their consumers. It was undoubtedly a fact that the ordinary plumber whose general work embraced the fitting-up of houses with hot and cold water, and running gas-pipes through the walls, was not the man who had kept himself to the forefront with knowledge as to gas appliances and the way they should be treated, or even knew whether the particular appliances proposed to be used were suitable to any particular rooms. All these points had to be taken into consideration very seriously if the gas departments were to have satisfied consumers; and, in order to do this, it was the opinion of many of them that the ordinary working plumber or gas-fitter should go to school upon these particular points; and all the help which could be given to him should be accorded by the various gas undertakings of the country. With the multitudinous improvements which were now being made—high-pressure gas and all the rest of it—there was very great need for special competence in gas-fitters and plumbers; and in order to get this, if they were to carry out the work rather than for the gas departments to do it for themselves, there was need for them to get some thoroughly scientific education, so as to learn some of the first principles of the proper mixture of air and gas. Undoubtedly Mr. Watson's paper would cause them to think; and if their thinking went to the extent of inspiring them to put some of his ideas into force, then his paper would have been of great benefit to the Association.

Mr. H. Kendrick (Stretford) said there was a great deal in Mr. Watson's paper which interested the company engineer. The representatives of corporations had not the same advantages as those of companies. The former had always to consult the electors; and this meant that there was considerable limitation to what they could do without getting into trouble. He had had experience both under corporations and under a company (in his present position), and was quite acquainted with the arguments on both sides. He had endeavoured to carry out, by the instructions of his own Directors, what Mr. Watson and other engineers had endeavoured to carry out under corporations—that was, to do his best work with the plumbers of the district, provided they would work to his regulations. He had given them facilities and offered to supply them with goods at the cost price to the Company, if they would only bring their customers to the Company. They were met, however, with the same argument—that neither the Corporation nor the Company ought to be allowed to deal in gas-fittings; their rights ended with the making of gas. They could not accept such a position. They replied that their interest went beyond the production of gas, and went as far as seeing that the consumers got the best value for their money; and they could only do this by going into consumers' houses and seeing that their apparatus was in order and in the best condition for giving the best service. One of Mr. Watson's remarks was that the interest of the gas undertakings lay in the satisfaction of the consumers. This was a motto that his particular Board had insisted upon his following—that he was to do all he possibly could to give satisfaction to consumers; and it seemed to him that this was what all gas undertakings ought to do. His Board had for the past seven years been following on the lines Mr. Watson had laid down in regard to maintenence work generally; and although it was impossible to say what the result had been in extending their business in lighting, certainly they had had a very good indication indeed of what it had done so far as the day-load was concerned. One other item he would like to refer to was the training of gas-fitters. This was a question in which all of them in the Manchester district had taken a very considerable amount of interest. From his experience, not only as a gas engineer but also as an outdoor superintendent of one of the large undertakings in Lancashire, he was imtimately brought into contact with the plumber there; and the lamentable lack of interest and knowledge of even the most simple matters relating to gas supply and gas apparatus was so impressed upon his mind that he had never ceased to do what he could to introduce a change. The want he had spoken of had been even more brought before his knowledge through his present duties. With the expansion of gas apparatus, increased knowledge was absolutely required; and consequently some classes were formed at the Salford Technical School a few years ago. An invitation was then sent out not only to the whole of the gas undertakings in the immediate neighbourhood, to attend these classes at a very small inclusive fee, and receive what instruction could be given, but the invitations were sent out as well to the whole of the plumbers in Manchester and Salford and the surrounding districts. The result was that, in the first year, there were 63 students, and of these 61 were connected with gas undertakings and only two with plumbers. This was rather a blow for the people who supported these particular classes; and it was to be hoped that the circular which would go with the scheme of training which was now on foot would enable them to get, in the gas-fitters of the future, a very much more systematic and trained body of men, who would be able to carry out the work systematically and scientifically, to the great benefit not only of themselves, but also of the gas industry as a whole.

Mr. W. M. Mason (the Secretary of the Association) here made some remarks on the general work carried on by the Association Executive. [They appear on p. 805.]

Mr. R. J. Rogers (Birmingham) said it struck him what great differences there were in the undertakings of the country with regard to the sales of gas per consumer. It was very difficult to understand why this should be. The great differences in the average sales per consumer indicated that in most undertakings the saturation point in regard to apparatus placed out had not yet been reached. There was still very great room for means by which the satisfaction of the gas consumer should be increased. During the year 1912 the Birmingham gas sales were over 48,000 cubic feet per average consumer. In 1913 the sales reached 52,000 cubic feet—compared with 29,000 cubic feet, the average of the municipal undertakings given by Mr. Watson. The very high figure which Birmingham was able to produce was possibly due to its position in regard to manufacturers, and in regard to the possibilities of gas in relation to its heating qualities, which, as most of them knew, had been exploited as far as possible by the Birmingham Committee. But he thought a great deal more might be done in many cases in increasing the present sales of gas. They heard a great deal of talk about new business; and they must, of course, get new business. But at the same time it was important that they should look after the present consumer; and he did not think that this point was always appreciated as fully as it might be by gas administrators. In order to do this satisfactorily, there was no doubt that the undertaking, if it was a municipal undertaking, must not be hampered by any such suggestions as they had heard a great deal of that afternoon. The authorities must be able to go into the houses of customers and see whether they were using gas to the best advantage and whether, if there were objections as to faults of gas usage, these objections could be got over. In Birmingham they were on the right side of the master gas-fitters. They were working in entire accord with them; and the master gas-fitters were working actively for the interests of the undertaking, which was one of the reasons for the success of the undertaking in pushing sales generally. There was a point that arose where there was talk of maintenance in the Council; and this was in regard to mantle supplies. At Birmingham they had an arrangement whereby the mantles used were obtained from the shops of the private gas-fitters in the district in which a man might be working—standard mantles being approved and standard mantles used in all cases for maintenance purposes. He quite sympathized with Mr. Watson in his difficulty with regard to getting an inspector for gas-fittings; and he hoped Mr. Watson would be able, very shortly, to have such

an official, because he was certain that, in the direction of seeing whether or not a customer was getting the right thing, a great deal depended on whether he was satisfied. With regard to the training of gas-fitters, he had for some time had the subject very closely at heart. As the member of the Gas Department staff who received complaints, he knew that a great number of complaints were traceable entirely to defective work which never ought to have happened, and caused by the ignorance of the man who did the work. At Birmingham they had had to inaugurate their own technical classes, which had been in operation for some years; but at the same time he thought that the national scheme for gas-fitters' education was required, and would be a very pertinent factor in the extension of gas sales. He would like to take this opportunity of voicing the opinion he had heard expressed freely in the Midlands—that the examination proposed should not be of such a character as to tax the qualifications of the candidates by a written paper, but should rather be a test of the value of the candidate as a practical workman. He thought that they could leave the matter quite safely in the hands of the examiners appointed by the Institution of Gas Engineers; but this was a point that they must not lose sight of. Mr. Watson had mentioned with regard to suction-gas plants the effect of the differential prices for gas for power purposes. Whereas a few years ago they in Birmingham had upwards of 200 suction-gas plants, with the reduction in the price of gas for power purposes they had been able to reduce the number to less than 40; and he was told by the majority of manufacturers using these plants that it would only be a matter of time before these had all disappeared. He thought that any gentleman who was in an area which had not differential rates for power gas would do very well to at once look into this matter.

The Chairman said they were having the plumbers of Bradford to meet them at their next meeting; and he had been looking forward to a little guidance for the occasion from the present meeting. So far as he could see, the plumbers of Yorkshire wanted to have both the halfpenny and the spice; and he did not see that they could possibly have both.

Mr. Watson, in replying to an incidental remark made in the course of the discussion, said he had the figures taken out for a number of the most important gas undertakings, both municipal and company, during the period of six or seven years; and it was a significant fact that when these figures were submitted to him he noted that, not only had the average gas consumption in the case of municipal authorities per consumer been almost steady up to 1912, but with 1912 the figures began to rise. The reason he had suggested—that the undertakings in question had benefited by the work of the Association—was that the particular undertakings where the average had been brought up had, to his absolute knowledge, adopted progressive measures within the last two or three years, and the figures which he had before him showed that the average would have been still higher but for the fact of two or three undertakings which he knew of his own personal knowledge had been anything but progressive, and whose figures had dropped rather than risen. This was the reason why he had attributed the increased sales per consumer as being due to the work of the Association, because the Association had stimulated activity. The purpose of his paper had not been so much to deal with gas-fitters' education or differential rates, as to explain some of the obstacles with which they who had to deal with municipal undertakings were surrounded; so that suggestions might be made to the meeting, by those who had to some extent surmounted these obstacles, that might be of benefit. Mr. Meunier and Mr. Kendrick had both instanced the difficulty of getting into working arrangements with master gas-fitters and ironmongers in different towns. It was a difficulty which they had all experienced. Though the gas-fitters were in a minority, and therefore their interests need not necessarily be specially considered, it must be remembered that the men (representing the gas-fitting interest) were, as a rule, members of tradesmen's associations, and were backed-up by the majority of the tradesmen of the town in matters called "municipal trading." They, in Doncaster, had had this difficulty to face. Some years ago they did a little gas-fitting work, and there was considerable objection; and even members of the Council objected to their doing the work. These objectors represented the tradesmen of the town, and they had a right to voice the opinions of these tradesmen. As a consequence, they ceased for a year or two from doing anything at all beyond the meter. Where they had a chance of getting at the consumer, and giving advice, they referred the consumer to some tradesman. The result was that for a winter or two, though they had been trying to push gas-fires, very little work was done in regard to such appliances. But some years ago they approached the gas-fitters to try if they could get some sort of working arrangement whereby they might have a free hand to push gas-stoves. Objections were raised, and they were strenuously opposed; but, after some negotiations, a scheme was devised which was accepted by the principal gas-fitters and ironmongers in the town. The scheme had been running through the past winter, and had been instrumental not only in helping the Gas Department to get gas-fires out, but had materially increased the gas-fitters' personal sales to consumers—sales with which the Gas Department had no direct connection whatever. As to the direct connection of the gas undertaking with the consumers, he was hoping (because there seemed to be no other means possible) that they would be able to get over their trouble by means of an arrangement if they could fix a reasonable agreement which would allow them to appoint an officer or inspector to go round the town, and visit the consumers and sell anything he thought desirable and that would be to the advantage of the trading interest. The chief point he wished to make was that municipal gas undertakings, under existing circumstances and conditions for gas supply, had their hands tied, and they wanted some means of working without such a difficulty in front of them. He had referred to the question of gas-fitters' education simply to give information to those present as to what was being done, in the hope that in their respective towns they might do their best to enlist the sympathy of master gas-fitters and ironmongers and help them pecuniarily. It was good work, and also very useful, because it would tend to effect agreement between the gas undertakings and the trading interests of the town. With reference to differential rates, his intention had been not so much to advise differential rates as to point out that gas undertakings wanted to have a fairly free hand so far as the fixing of prices was concerned.

PROFESSOR BONE ON SURFACE COMBUSTION.

First Howard Lecture at the Royal Society of Arts.

At the Royal Society of Arts, on Monday last week, Professor W. A. Bone, D.Sc., F.R.S., delivered, before a large audience, the first of the series of Howard Lectures of which a syllabus appeared in the "Journal" for the 10th inst.; his subject being "Flameless Combustion." The lecturer dealt mainly with the early investigations into the question, and followed the lines of his recent discourse at the Royal Institution [see *ante*, p. 572].

Sir Humphry Davy's Discovery.

Professor Bone began by directing attention to the discovery by Sir Humphry Davy, during his researches upon flame in 1817, that combustible gases will combine slowly with oxygen at temperatures below the actual ignition-point. This led him to try whether the temperatures of these slow combustions, being lower than that required to produce flame, might still be high enough to make solid bodies incandescent. He tried the effect of introducing a warm platinum wire into a jar containing a mixture of coal gas and air rendered non-explosive by an excess of the combustible, and the wire immediately became red hot, and continued so until nearly the whole of the oxygen had disappeared. The lecturer repeated the experiment in a modified form with the aid of a platinum crucible and a bunsen burner, and showed that when the crucible was warmed by the flame, and the flow of the explosive mixture was momentarily arrested and then renewed, the gases, instead of burning with flame at the head of the burner, combined without flame over the platinum surface, and caused it to glow.

Though Davy was undoubtedly the first chemist to observe and record an instance of surface combustion, Dr. Bone pointed out that he was very far from recognizing that all incandescent surfaces are equally capable of effecting it. This was a quite modern discovery. During the twenty years that followed Davy's discovery, several very distinguished chemists—notably Dulong and Thénard, Dobereiner, William Henry, and Thomas Graham—investigated the matter. But no experiments were made with the various substances dealt with in a state of incandescence; the observations being confined to inducing slow combustion at low temperatures.

Views of Deville and Frederick Siemens.

In 1836 interest in the subject suddenly dropped, and was not revived for more than half-a-century. Meanwhile the researches of Deville upon the dissociation of steam and carbon dioxide at high temperatures, in which he had employed incandescent surfaces, had given rise to the wholly mistaken notion that because such surfaces promote dissociation they must necessarily hinder combution, and that therefore, in furnace design and construction, the contact of burning gases with hot surfaces should be avoided. The late Mr. Frederick Siemens strongly upheld this view; and such was the weight of his authority in all matters relating to large-scale heating operations that for a generation his dictum was accepted without question by technical men. Seeing that his views exercised so enormous an influence upon contemporary thought and practice, the lecturer thought it might be of interest to consider them at close quarters. Siemens was of opinion that, inasmuch as "a flame consists of a chemically excited mixture of gases whose particles are in violent motion . . . it follows that any solid substance brought into contact with gases thus agitated must necessarily have an impeding effect on their motion. In the immediate neighbourhood of such surfaces, the combustion of the gases will cease altogether, because the attractive influence of the surfaces will entirely prevent their motion." Moreover, in referring to the influence of dissociation, he pointed out that Deville and others had made use of small vessels of special material, and that the results depended very much upon the various kinds of surfaces employed, which, by some peculiar influence upon the surrounding gaseous medium, had directly caused the dissociation effected. He consequently concluded "that solid substances have a twofold influence on combustion, because they interfere with the rapid motion of the gases necessary for combustion; and, in the second place, they cause dissociation, and by doing so, of course, a great amount of heat is

lost," and, further, that "complete combustion is impossible whenever live or active flame is allowed to come into contact with any solid surfaces." Professor Bone said no one had a greater admiration than he for the scientific work of Frederick Siemens, and for the benefits which had resulted to the world from his teachings as a whole. But, in the interests of scientific truth and technical progress, he must point out that he was wrong, and misled others, in his conception of the influence of surfaces upon combustion. It was, of course, true that a cold surface thrust into a flame will cool the layers of combining gases in its immediate vicinity below the ignition temperature, and so prevent the completion of combustion; but this did not apply to a hot or incandescent surface, which undoubtedly accelerated combustion. In the second place, if an incandescent surface accelerated the dissociation of steam, it must also of necessity accelerate the combination of hydrogen and oxygen in like degree. Moreover, Siemens never appeared to have contemplated the possibility of a high-temperature flameless combustion, much less that such combustion, if realizable, would be a faster process than ordinary flame combustion.

Fletcher's Experiments and Conclusions.

Passing on to refer to the work of the late Thomas Fletcher, who, in his way, did so much in the direction of developing the uses of gas in small-scale operations, Dr. Bone said he seemed to have arrived at a clearer conception than any of his contemporaries about the influence of surfaces in combustion. In a lecture he delivered at the Manchester Technical School in 1887, entitled "Some Curious Flames,"* he demonstrated the possibility of realizing a flameless incandescent surface combustion in contact with metals other than those of the platinum group. The lecturer quoted his exact words, so that there might be no misunderstanding as to what he did and taught on that occasion. He said:

> I will now dispense with flame altogether, and show you the same quantity of gas and air burning as before, but in the most perfect form; the combination taking place on the surface of the substance to be heated without any flame. To show this so that all can see, the mixture of gas and air is directed on to a large ball of iron wire—flame being used at first to heat the wire to the necessary temperature to continue the combustion. By stopping the gas supply for an instant, the flame is extinguished, and the combustion is now continued without any flame, but with an enormous increase in the heat obtained. This invisible or flameless combustion is only possible under certain conditions; and one essential point is that the combustible mixture shall come into absolute contact with a substance at a high temperature which is capable of absorbing the heat as it is generated. . . . In the absence of a solid substance at a high temperature, it is impossible to cause combustion without flame; and when a flame is used, it is also impossible to make it touch a cold surface.

Professor Bone remarked that if anyone was inclined to say that what Mr. Fletcher did was merely an extension of Davy's experiment to the case of iron, he would declare at once that he disagreed with him. It had been asserted in the Technical Press and elsewhere, by people who ought to know better, that all late developments in surface combustion were merely applications of Davy's discovery in 1817. A moment's consideration would show that this was not really the case. He did not think that Davy, in his reflections upon the phenomenon observed when a combustible gas and oxygen are combining over a glowing surface of platinum, ever got so far as to conceive of an intensification of ordinary flame combustion by such means; indeed, he never got farther than his original proposition—that, inasmuch as the temperature of flames far exceeds those at which solids become incandescent, a metallic wire can be maintained in a state of glow by the flameless combustion of gases at its surface. Mr. Fletcher, on the other hand, realized that a change-over from the ordinary flame to the flameless combustion of gas and air in contact with the iron ball resulted in "an enormous increase in the heat obtained," by which he obviously meant the attainment of a higher temperature. In this he made a distinct advance upon Davy's conception. The lecturer added that, so far as he was aware, Mr. Fletcher unfortunately did not follow up the matter beyond this point, either in its theoretical aspects or its practical applications; and his work had but little influence upon contemporary opinion or practice. Indeed, practice was then too much under the spell of Siemens's genius to be ready for any striking development of Fletcher's ideas.

Later Investigations.

During the nineties, a great many circumstances directed the attention of chemists once more to the possible influence of hot surfaces upon gaseous reactions. It was now generally recognized as a well-established principle that all hot surfaces have an accelerating influence upon chemical interactions in gaseous systems. In other words, if at any given temperature one gaseous system tends to pass over into another, contact with a solid at that temperature will accelerate the process. The lecturer gave two examples of this which had come within his own experience. It was therefore necessary, he said, to distinguish between two possible conditions under which gaseous combustion may occur—viz. (1) homogeneously or equally throughout the system as a whole, at temperatures below the ignition-point slowly and without flame, and at temperatures above the ignition-point rapidly and with flame; and (2) heterogeneously or only in layers immediately in contact with a hot or incandescent surface. It was also necessary to remember that, other things being equal, the latter surface combustion was a faster process than the normal homogeneous combustion of ordinary flames.

Professor Bone's Researches.

The lecturer's own researches began with an attempt to elucidate the factors operative in the combustion of hydrogen and carbon monoxide in contact with a variety of hot surfaces at temperatures below 500° C. The principal conclusions established were: (1) That the power of accelerating gaseous combustion is possessed by all surfaces at temperatures below the ignition-point in varying degrees, dependent upon their chemical characters and physical texture; (2) that such an accelerated surface combustion is dependent upon an absorption of the combustible gas, and probably also of the oxygen, by the surface whereby it (or they) becomes "activated" (probably ionized) by association with the surface; (3) that the surface itself becomes electrically charged during the absorption and "activation" of the gases (negative for the combustible gas and positive for oxygen), the charging being due to ionized gas leaving the surface; and (4), finally, that certain important differences from a chemical point of view between homogeneous combustion in ordinary flames and heterogeneous combustion in contact with hot solids have been established, so that there can be no longer any doubt as to the reality of the phenomenon.

Concluding Remarks.

Professor Bone said the considerations he had explained convinced him some years ago that if an explosive mixture were either injected on to, or forced through the interstices of, a porous refractory incandescent solid under certain conditions, greatly accelerated combustion would take place within the interstices or pores, and that the heat developed by this intensified combustion would maintain the surface in a state of incandescence without any development of flame—thus realizing the conception of flameless incandescent surface combustion as a means of greatly increasing the general efficiency of heating operations wherever it could be conveniently applied. And later on he dealt with the critics who, while admitting the accelerating influence of an incandescent surface upon gaseous combustion, are sceptical about the process being really flameless. Some of his remarks upon this point were similar to those made in the course of his Royal Institution lecture already referred to.

In conclusion, Dr. Bone said he had endeavoured to give an accurate statement of the historical and scientific aspects of his subject, so far as they were known to him; and in the next lecture he hoped to deal still further with his own discoveries in relation to flameless incandescent surface combustion, and the numerous technical applications which had resulted therefrom.

The lecture was illustrated by experiments and lantern slides; and at its close Dr. Bone was warmly applauded.

* See "Journal," Vol. XLIX., p. 168.

DISCOLORATION OF SULPHATE OF AMMONIA.

On behalf of the German Coke-Oven Commission, Herr K. Leo, of Wattenscheid, has issued a report on this subject, which appears in the number of "Glückauf" for March 14. The following is a translation of the report, which should prove useful to manufacturers of sulphate of ammonia—gas-works and coke-ovens alike.

The sulphate of ammonia, says the report, put on the market by coke-ovens is only in a small minority of cases anything approaching pure white. Mostly it is light grey, as generally stipulated in contracts for its sale. The method of production, impurities in the acid used, or any small external disturbances may contribute in varying degrees to the discoloration, which, as already stated, is generally grey. But a number of other colours—blue, red, brown, or yellow—also make their appearance at times, though they should give rise to no objections on the part of purchasers, since often extremely small proportions of impurities lead to considerable discoloration, without being in any way detrimental to the manurial properties of the sulphate.

Grey Coloration.

This is generally due either to impurity of the sulphuric acid used, or to slight irregularities in working. First may be mentioned the case of working at too high temperatures, when particles of tar fail to separate out, and are carried forward with the gas. In the direct process, these separate out with the salt in the saturating vessel, and give it a grey colour. Or else the liquor reaches the ammonia separating apparatus carrying tar with it, and this has the same effect. In both these cases, tar particles in the salt can generally be detected with the naked eye.

Again, a grey colouring of the salt may be caused by small quantities of copper or lead contained in the sulphuric acid used. Their sulphides separate out with the sulphate, and occasion grey coloration, especially when closed concentrating vessels are used, with which it is not generally possible to remove the scum which forms (unless Drehschmidt's patented scum-catcher is used). The colouring power of acids containing lead and copper is, however, not always the same. Experiments made by the author (further referred to later) on the degree of colouring

as depending on the quantity of impurities in the acid, showed that a 60° acid with a copper content of 0·01 per cent. gives a salt with a distinctly greyish tint. With 0·03 per cent. of copper, the fresh salt is of dark grey colour. The colour, however, becomes distinctly lighter during storage, as the easily oxidizable copper sulphide is converted into the sulphate, which hardly gives any colour at all to the salt. The colouring effect of lead is far weaker; and any coloration due to it takes place at a later degree of concentration in the acid bath than is the case with copper. The 60° acid contained 0·03 per cent. of lead before any distinct grey tint was observed in the ammonium sulphate, and 0·1 per cent. before any dark grey was noticed. But grey coloration due to lead does not diminish during storage.

Blue and Red.

The formation of blue salt was examined and explained by Bailey.* According to him, it is brought on by the action of volatile cyanogen compounds on the iron contents of the acid, and according to the equations:

$$6\,(NH_4)\,CN + FeS = (NH_4)_4\,Fe(CN)_6 + (NH_4)_2\,S.$$

$$(NH_4)_4\,Fe(CN)_6 + 2\,FeSO_4 = Fe_2\,Fe(CN)_6 + 2\,(NH_4)_2\,SO_4.$$

Therefore, according to Bailey, this blue coloration can only occur when local or total alkalinity produces a precipitate of ferrous sulphide, with which the alkaline cyanides entering the saturator can interact; and if the saturator be kept sufficiently acid, blue salt should not be obtained except when excessive priming occurs. The only way of avoiding the possibility of obtaining a blue salt would be to remove the cyanogen compounds by some process from the liquor before distillation. A few suggestions on this point are to be found in the well-known work of Lunge and Köhler, to which the author recommends reference. At the same time such purification of the liquor would avoid the red coloration observed from time to time, which is also traceable to sulphocyanide compounds of the iron. This will generally first become visible during storage, and in proportion to the oxidation of the iron salts. Thus it has often been observed that the outer layer of salt in store becomes red, while that underneath remains perfectly white. To avoid this coloration, it can only be strongly recommended always to use sulphuric acid free from iron. This is, however, very difficult to carry out, as almost all commercial sulphuric acid contains more or less iron in solution—generally some 0·02 per cent.

Brown and Yellow.

Brown, and perhaps yellow-brown, colorations can generally be traced to impurities of tar-oil nature, but not so much brownish-yellow to yellow tints. A definite yellow tone is almost always due to arsenic in the sulphuric acid. By dissolving a fairly large, accurately weighed quantity of sulphate of ammonia—*e.g.*, 200 grammes—in 500 c.c. of hot water and filtering, after weakly acidifying with some 30 c.c. of dilute (1 : 5) sulphuric acid, and saturating the solution with sulphuretted hydrogen, it is easy to quantitatively analyze the well-washed residue. The author gives the result of such a test in a sample of distinctly yellow ammonium sulphate, selected at random, which yielded an insoluble yellow-brown residue of 0·123 per cent.

Soluble Components.	Per Cent.		Insoluble Components.	Per Cent.
Moisture	1·11		Soluble in CS_2	0·0054
Free acid	0·317		As_2S_3	0·088
Total NH_3	25·13		PbS	0·01
$FeSO_4$	0·048		CuS	0·012
$ZnSO_4$	0·007			

In this case about 71 per cent. of the coloured residue consisted of the yellow sulphide of arsenic, which had given the colour to the sulphate of ammonia.

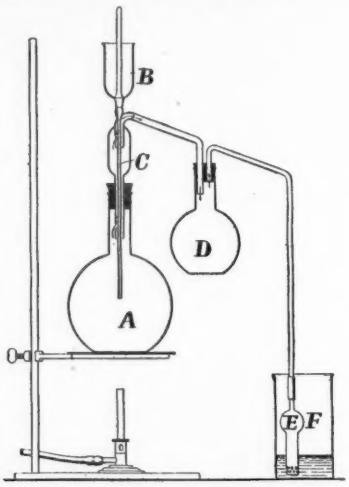
Experiments made with acids showed that 0·01 per cent. of arsenic just coloured the sulphate of ammonia, while 0·03 per cent. gave quite a strong colouring. But as the acid often contains small quantities of copper as well as arsenic, and tarry particles find their way into the acid concentrating bath, the yellow colour often goes into grey and brownish-yellow. For example, with 0·01 per cent. of copper and 0·03 per cent. of arsenic in the sulphuric acid, a grey-brown salt, with a trace perhaps of yellow, is obtained. But, if the copper is increased to 0·03 per cent., and the arsenic remains the same, the salt has quite a dark grey appearance. The degree of oxidation of the arsenic may also play quite an important part. If it is in the form of arsenical acid, the yellow coloration is less than with arsenious acid, for the reduction must be complete before the sulphide is formed.

Other substances, besides arsenic, can cause yellow coloration of ammonium sulphate. The author has seen cases where the scum forming on the saturating bath has been more or less of a yellowish-brown shade, when the acid (tested in every case) showed only traces of arsenic—0·005 per cent. at the most; so that the colour of the salt could not be attributed to this cause. The salt was tested, and left an insoluble residue closely resembling the scum from the saturator. The latter was accordingly washed, dried, and analyzed, and was found to contain as much as 28·83 per cent. of cadmium sulphide, as against only 5·1 per cent. of arsenic (in the form of trisulphide). In the same sample were found 33·65 per cent. of lead sulphide, 9·25 per cent. of zinc sulphide, and 13·3 per cent. of residue soluble in carbon bisulphide. In this case, and other similar ones quoted by the author, the yellow colour was undoubtedly to be attributed to the cadmium, and, indeed, when the acid was tested, it was found to contain 0·053 to 0·013 per cent. of cadmium. Such acids should therefore be avoided.

Separate tests on the colouring strength of cadmium showed that 0·01 per cent. in the acid is sufficient to give the ammonium sulphate a distinct yellow colour, with a tendency towards red, which is distinctly stronger than that caused by arsenic. Quite a dark yellow is caused by 0·03 per cent. of cadmium. Whereas with 0·03 per cent. of arsenic a similar quantity of copper is sufficient to occlude the yellow tint, with the same amount of cadmium the yellow colour shows clearly through.

Determination of the Colouring Strength of Acids.

In order to determine experimentally the effect of impurities in various commercial sulphuric acids in discolouring the sulphate of ammonia, the author made use of the ordinary saturating process on a small scale, by taking 200 c.c. of pure acid of 41° Beaumé, equivalent to 178·5 grammes of 60° acid, containing a definite percentage of the various impurities; so that, if complete neutralization took place, 187·7 grammes of sulphate should be obtained. The author recommends the use of the apparatus shown in the accompanying diagram. The 1000 c.c. flask A used for the generation of the ammonia contains 188 grammes of ammonium sulphate with 100 c.c. of water added. Through the



rubber stopper is passed a distilling apparatus which, without any loss of ammonia, allows the quantity of caustic soda (350 c.c. of sp. gr. 1·35) required for driving off the ammonia to pass slowly in from the funnel B through the tube C, which can be shut off at will. The ammonia gas as it is driven off passes through the flask D, and so to the sulphuric acid (200 c.c. of 41° Beaumé) in F, which contains the quantity of impurities required for the particular test in hand. When the last of the caustic soda has reached the stop-cock in the tube C, the funnel should be rinsed with water, and the stop-cock closed. If the evolution of ammonia is slow, heat should be applied. During the distillation, a very small stream of sulphuretted

* See "Journal," Vol. XCVIII., p. 322.

Sample Number.	Impurities in Acid.	Colour of Sulphate.	Impurities in Acid.	Colour of Sulphate.	Impurities in Acid.	Colour of Sulphate.
1	Tar-oil and small amount of tar, about 1·2 per cent.	Dark grey-brown	0·01 per cent. As	White with faint light yellow tinge	0·01 per cent. Cd.	White with faint light yellow tinge
2	Oil without tar, about 1·2 per cent.	White with reddish tinge	0·03 per cent. As	Light yellow	0·03 per cent. Cd.	Bright reddish yellow
3	Oil + 0·01 per cent. Cu.	White	0·05 per cent. As	Light yellow	0·05 per cent. Cd.	Bright reddish yellow
4	0·01 per cent. Cu.	White	0·05 per cent. As	Lemon	0·075 per cent. Cd.	Reddish yellow
5	0·03 per cent. Cu.	White with light grey tinge	0·03 per cent. As + 0·01 per cent. Cu.	Rose	0·03 per cent. Cd. + 0·01 per cent. Cu.	Light grey
6	0·05 per cent. Cu.	White with grey tinge	0·03 per cent. As + 0·03 per cent. Cu.	Violet grey	0·03 per cent. Cd. + 0·03 per cent. Cu.	Light grey
7	0·03 per cent. Cu. + 0·03 per cent. As (as As_2O_5)	White with faint grey tinge	0·03 per cent. As + 0·03 per cent. Pb.	Light yellow	0·03 per cent. Cd. + 0·03 per cent. Pb.	Bright reddish yellow

hydrogen is passed into tube E by means of a bent glass tube. Condensation of the ammonia vapours is avoided by the gentle warming of the flask D. At the end of the distillation, the acid bath should be made up to about 200 c.c. by the addition of distilled water. The process is complete when the smell of free ammonia is no longer detected in the fumes from the beaker F, and the contents of the beaker should by this time be fairly thick. They are dried on a Büchner vacuum apparatus, and twice washed with 30 c.c. of absolute alcohol. The salt is then pressed dry between filter papers.

This test is easy to carry out, and soon indicates what quality of ammonium sulphate may be expected with any particular sulphuric acid—of course provided that no external disturbances occur. The effect of impurities in the acid in a few cases that were examined by the author is shown in the table.

CARBONIZING COAL IN LARGE QUANTITIES.

In the "JOURNAL" for May 21, 1912 (p. 516), a description was given of an improved process devised by M. Breuillé for the carbonization of coal in large quantities. He has since made some changes in the appliances for carrying out the process, and they are the subject of an addition to his original French patent. They are indicated in the following particulars translated from the specification [No. 18,111], which has recently been published.

Fig. 1.

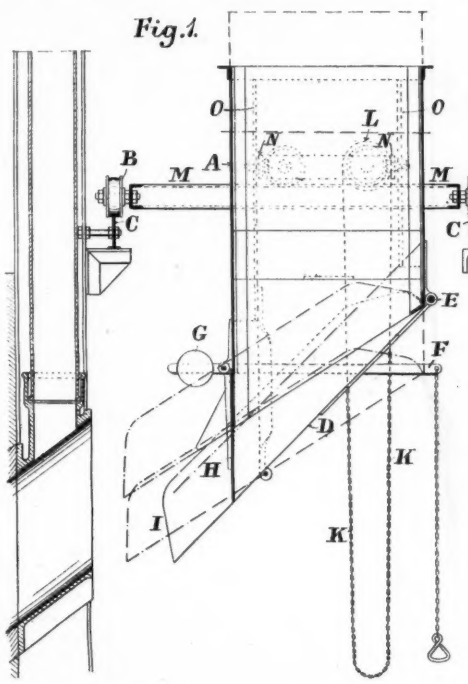
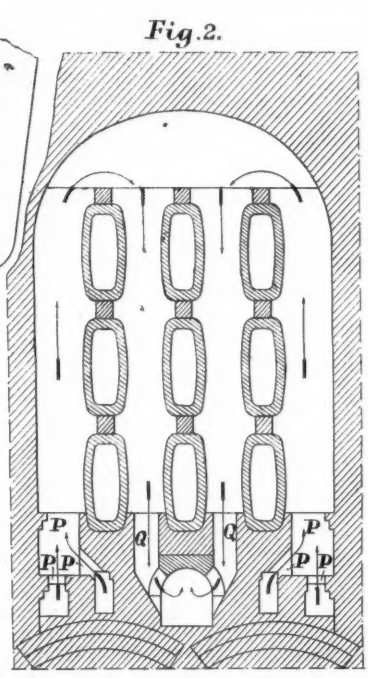


Fig. 2.



In the accompanying diagrams, fig. 1 is a side elevation of the charging-hopper with movable bottom, and itself movable in the direction of its vertical axis, placed opposite the front of the setting in the position suitable for charging one of the inclined retorts; fig. 2 is a vertical section of a setting of retorts, having nostrils at the sides and openings for flames near the centre.

In the original patent a description was given of a charger for the different levels of the inclined retorts. This device utilizes a charging-shoot with a sloping bottom, allowing of a more or less complete filling of the retort according to the height of the fall of the coal into the shoot and the distance of the point of fall from the entrance to the retort. The device is suitable when it is merely a question of a shoot of a specified length, which only acts as an intermediary between the spout of the hopper running along the entire length of the settings and the mouth of the retorts. But it is not so when the coal-hopper is at the extremity of the settings, and the shoot must be a receptacle in which to take the charge from the hopper, and which will be conveyed, by means of a truck running on wheels, to the front of each retort. In this case, the result is not attained without employing a hopper charger A (fig. 1) moving horizontally upon wheels B along rails C. This charger has not only a sloping bottom D capable of assuming a variable angle of inclination on the shaft E, but it can be raised and lowered by hand at the proper time for a distance corresponding to half the height of the retort, so as to allow the projection of the coal from a greater height if necessary. By combining the height of fall with the slope of the bottom, the coal is thrown more or less forcibly, and thus the depth of the charge is varied. By displacing the gate H by working the lever F, with its counterweight G, by means of the handle and chain shown, a more or less large passage is opened for the coal gliding on the bottom. Variations in the angle of inclination of the bottom are obtained by altering the length of the gate.

Transverse horizontal displacement of the charger, to bring the spout I of the bottom into the mouth of the retort, is effected by pulling the endless chain K, which makes the axle of the wheel L turn so that it will run along the girder M. Vertical displacement of the charger is produced by raising or lowering it by hand when it is empty, and fixing the bolts in the uprights O.

With inclined muffle retorts there is the advantage of being able to charge them with a double or triple quantity without any increase in the length of time for heating being necessary, because the charge of carbonized coal is gradually converted into coke from the exterior inwards. The result is still better when the retorts are very narrow and high, as shown in fig. 2, which is preferable to figs. 4 and 5 of the original specification, because the flames striking the sides of the retort can thus act on a less dense mass of coal, and more rapidly produce coke.

Another improvement made in the principal patent consists in constructing the setting with inclined or muffle retorts of the shape shown in fig. 2, and with nostrils P at the sides—*i.e.*, under the retorts; the flames being made to emerge at Q in the centre of the setting, so that they strike the sides and then return to the centre in the direction shown by the arrows. This gives a more regular heating of all the retorts. This arrangement is particularly advantageous when ordinary inclined retorts are replaced by inclined muffle retorts, such as those shown in fig. 2, where the sole, instead of being horizontal, as shown in figs. 4 and 5 of the original specification, is placed vertically. The result is that intake of the flames through the side nostrils P, with exit of the flames in the centre at Q, produces the maximum effect; for the two outer sides of the retorts are uniformly heated, with resulting equal transmission of heat on both sides, identical coking, and consequent production of a superior coke, a large yield of gas of the highest heating power, fluid tar, and ammoniacal liquor. Moreover, equality of heating of the two long vertical sides of the retort assures a maximum resistance of the refractory materials.

Electrical Ignition of Gaseous Mixtures.—At a recent meeting of the Royal Society, Professor W. M. Thornton gave the results of an experimental examination of the mechanism of the ignition of gaseous mixtures by electrical sparks. It is found that there are two distinct types of curves connecting percentage of gas in air and the least current which, when broken, causes ignition by the break-spark. In one, characteristic of continuous currents, the current required is proportional to the percentage of gas present; in the other, of alternating-current type, it is a quadratic function of the percentage, having a minimum, at the mixture giving combustion, midway between carbonic oxide and carbonic acid. In the paraffin series, the minimum continuous current is the same for all the gases; but with alternating current the gases with more complex molecules require larger igniting currents. The slope of the one type and the minimum current of the other are both proportional to the number of atoms in a molecule of combustible gas more nearly to the hydrogen atoms. It is inferred from the observations that ignition by continuous-current break-sparks is largely ionic or electronic; but that that by alternating currents is more nearly a simple thermal process. The gases examined were hydrogen, carbon disulphide, benzene, alcohol, and the paraffin series up to pentane.

PROCESS FOR OBTAINING HEATING GAS.

The "Athion" Gesellschaft have taken out a French patent [No. 462,740] for a process for the production of heating gas by utilizing the carbonic acid in burnt gases for gasifying, at high temperatures, combustible substances containing carbon. As the resulting gases consist to a great extent of carbon monoxides, they can be utilized for heating with gas under pressure, and again produce burnt gases containing carbonic acid, of which about 50 per cent. can be restored to the cycle of work. It is claimed that the process is profitable from the fact that, when the carbonic acid is being extracted by washing the burnt gases, it is possible also to remove the nitrogenous compounds. The carbonic acid can be utilized in different ways for gasifying fuel containing carbon. For example, it can be conveyed under the chamber of a gas-producer, and employed in increasing the proportion of carbonic oxide in the resulting gases. At the same time the producer can be kept cool to a certain extent, and the zone of fire enlarged—the cycle being endothermic. The effect is to lengthen the life of the producer. The gas generated is a mixture in which, instead of aqueous vapour, carbonic acid is introduced with air into the producer. Almost pure carbonic oxide is obtained when carbonic acid is employed as in the water-gas process—*i.e.*, in periodically producing alternately a hot and cold blast. In the first phase producer gas is generated; and in the second, almost pure carbonic oxide.

The process can be employed for the continuous production of almost pure carbonic oxide, even under pressure. Its combustion is brought about by means of gas-producers, which effect a better mixing, more systematic heating, and increased production of oxygen and nitrogen compounds, without allowing the gases to expand during combustion. The nitrogen compounds are extracted from the products of combustion of the carbonic oxide by cooling in the usual washers or with water, or by a combination of these methods. After the separation of the nitrogen compounds, carbonic acid is obtained in special washing plant, operating, for example, with a solution of carbonate of potash. The carbonic acid is extracted by heating from the lyes saturated with it, and employed again in the cycle of gasification of the fuel; or it can be liquefied after suitable cleaning and drying. One of the advantages claimed for this process is that the burnt gases do not pass into the atmosphere until after they have been purified.

A JOINT SCOTTISH JUNIORS' VISIT.

On Saturday members of the Scottish Junior Associations turned out in force at the Young's Paraffin Light and Mineral Oil Company's works, Uphall, to see the interesting forerunner of the modern vertical gas-retort; for, in this respect, the retorts at Uphall are more like those which have been installed at the various gas-works throughout the country, than those seen at Pumpherston last year.

The shale arrives at the oil-works in ordinary railway trucks, which are hydraulically up-ended, as in many gas-works. Then it passes down a shoot into the breaker, under which is the bottom of the chain-way. From there there is a simple means of carrying the shale to the top of the retorts—namely, by a long slope. This is possible, owing to the large area of ground available, and also to the quantity which has to be handled, which amounts to 750 tons a day. Hutches are filled, and then pushed by hand under the endless chain, which catches a forked piece of metal sticking up from the hutches; and this alone forms the attachment, while the weight of the chain is quite sufficient to keep the chain in its fork. There are safety-catches provided at about 20 or 30 yard intervals, in case the full truck should become detached and run by gravity towards the men occupied in filling the trucks at the lower end. A further safeguard is provided in case of anything going wrong upon the slope. This consists of a wire cord carried from top to bottom of the slope, which is attached to a gate-valve on the steam supply to the winding engine; so that, when the cord is pulled from any part, the valve is closed and the engine stops.

One thing which will strike the gas engineer in such a place is the fact that the pipes are not buried underground as in most gas-works, but either laid upon the surface or carried on standards overhead. They are easily examined, and their positions quickly ascertained. Another thing is the absence of house or covering to the retorts, which are out in the open. The men feeding the retorts are also in the open; but very few are required, even to handle the large quantity already alluded to. The simple arrangement of a greased smooth steel plate, at the top of the elevating chain-way, acts as a universal turntable, upon which the hutches are directed towards either of the six lines of metals over the rows of retorts. Each hutch contains about 17½ cwt.; and this amount goes into the hopper, above the retort proper, four times during each 24 hours. There are three benches, each containing eighty retorts, four retorts in a square formation forming a unit or setting; and each of these has a separate wrought-iron chimney. Air inlets at different levels cause combustion throughout the heated zone, which is brought to about 1750° Fahr. at the bottom of the retort proper. The retorts are of an oblong shape, like most of the coal-gas verticals. The hutches are brought over the upper lids, after the lid has been slid off by hand; and then the slide at the bottom of the hutch is withdrawn, and the shale falls into the retort, after which the lid is replaced by hand, as it is only held fairly tight by having a turned face. The retorts carbonize about 70 cwt. per 24 hours; and it takes 24 hours from the time the shale is placed in the retort until it comes out at the bottom, in the shape of ash, which is of much the same composition as that from ordinary coal. For the removal of the ash, corkscrews are provided under each retort, to continuously remove a small quantity into a hopper under the retort; and immediately under this corkscrew the steam is inserted. The outlet from this lower hopper is at the side, so that the trucks for its removal are alongside the bench, and not under it, as in most of the coal-gas installations. Consequently the bench is built upon the foundations and not upon an elaborate steel structure, as is necessary when the hutches have to be taken immediately under the retorts. In this respect, the shale worker is in a happier position than the gas maker, as the material he uses does not cake, and consequently there is no catching or holding-up as in a coal-gas retort. The quantity of gas, or rather vapour (as steam enters largely into the composition) is about 20,000 cubic feet per ton. The steam is used for taking as much of the ammonia out of the shale as possible; and this in these works is carried out so successfully that 47 lbs. of sulphate is obtained per ton of shale.

One sees here the germ of Young's "Peebles" oil process. In the first treatment of the gas or vapour, which contains about 40 per cent. of hydrogen, it is washed with oil to remove the oil which it contains; and thus the crude oil is secured. Of course, in the present case, it is oil that is required, not gas; but the process of oil washing is to absorb all that is not permanent gas from the vapour. Thus, when the oil-gas process was first thought of, all that had to be done was to crack the oil at such temperatures as would make not oil as in the oil-works, but permanent gases, which could not be washed out by the oil itself. Of the liquid products about 20 per cent. is tar; and this is not treated, but burnt under the stills, where it is steam-injected. To produce the gasoline (for private high-quality gas installations), the motor spirit, the burning and lubricating oils, and paraffin wax, which are the principal commodities marketed by the Company, a very large quantity of fuel is required, not only for the stills, where the fractionating of the oil takes place, but for the large number of boilers for the production of the steam, which enters so largely into the various processes undertaken, and for the many pumps about the works. Also for the freezing machines; for extreme cold as well as heat is used in the scheme for the manufacture of certain products. The retorts are, of course, gas heated.

After the tour of the works had been made, tea was provided in the offices; and Mr. John Wilson and Mr. William Geddes, the respective Presidents of the Western and Eastern Associations, voiced the indebtedness of their members to the Directors of the Company for the permission to visit the works, and for their hospitality, and also to Mr. John Bagshawe, Mr. R. Black, and Mr. W. W. Wilson for the trouble they had taken in showing the parties round. Mr. Bagshawe suitably responded.

Gas in China.

It is so seldom that anything is heard of the industry in China, that it is interesting to record that a contract has been granted to local capitalists for supplying gas to Mukden. A capital of a million yen (about £103,750) is to be raised, and the contract is to be for fifty years, with the option of purchase for the local authorities at the end of that period. It is proposed to erect works of 70 million cubic feet annual capacity. It is estimated that 13 miles of mains will be required, and 4000 to 5000 houses will be piped.

Improved Coke.

A German patent has been granted to Fingerland, Fadra, and Lissner for a process for desulphurizing coke. They recommend that materials which have catalytic properties—*i.e.*, metals, oxides, hydroxides, or other salts—be mixed with the coal before carbonization; and on the completion of distillation, suitable gases or vapours—such as chlorine—are passed through the coke. The products formed, such as chlorides of iron and sulphur, are vaporized in the stream of chlorine, and pass away without increasing the ash content of the coke. At the same time a portion of the hydrogen in the coke is converted into hydrochloric acid, leaving the coke richer in carbon. The removal of any chlorine remaining in the coke can be effected by a blast of steam, hydrogen, or water gas through the incandescent coke.

Norwegian Nitrate Industry.

Statistics which have recently been published show that Norwegian nitrate is being exported in increasing quantities—70,171 tons last year, compared with 51,701 tons in 1912. This means an increase of about 40 per cent. from the factories at Saaheim and Notodden; the value being about 11,000,000 kr., against 8,000,000 kr. in 1912 and 1,400,000 kr. in 1911. The export of cyanamide from the works at Odda, to which reference was made in the "JOURNAL" last week (p. 718), amounted last year to 22,111 tons, against 13,892 tons in 1912—an increase of about 60 per cent. The export of carbide also goes on increasing; the figure for last year being 66,876 tons against 63,100 tons for the previous year. Of ammonium nitrate and sodium nitrate the aggregate exports during 1913 were 17,028, against 13,480 tons in the year 1912.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Dublin Gas Affairs.

SIR,—My friends may like to know that I have severed my relations with the Alliance and Dublin Consumers' Gas Company, as occasional adviser.

Those who are shareholders are entitled to know that this step—contemplated for some time—has been expedited by the action taken in withholding, against my advice, a certain report which has long been promised to the shareholders, but which I find is being referred to by those who are canvassing for directorships in the Company.

Seeing that the whole of the officers of the Company, from the Chairman downwards, are so prevented from discussing these references in any shape, I can no longer take any part in the Company's service, however slender.

The position is, in my humble opinion, as unreasonable as if, for instance, the ratepayers of Edinburgh had a secret report made on why their gas was 1s. per 1000 cubic feet dearer than in Glasgow, and the capital expenditure nearly four times greater, while the experts responsible had no opportunity of explanation.

HY. E. JONES.

Palace Chambers, Westminster, S.W., March 21, 1914.

SIR,—I have to-night received my copy of the accounts of the Alliance and Dublin Gas Company for the half year ended Dec. 31, and the unfortunate results need from me, at this moment, no special condemnation. In any case I should meanwhile refrain from reviewing the affairs of the undertaking, with so strong an interest now awakened. That my criticisms have been justified is evident by the fact that groups or committees of stockholders have been formed in Scotland and the North of England and London. My sincere hope is that they will be able to combine together, and present joint action at the forthcoming meeting.

It would be a breach of etiquette for me to say more just now, as I have been invited to join the London Committee. Therefore for the time being my efforts must be conjointly with the other members.

In addition to the three British Committees or groups of stockholders, I do know, from letters sent to me through you, that there are quite a number of Irish stockholders sympathetic to my efforts and the general movement now on foot to improve the Company's affairs.

This much I feel at liberty to say, that the moment is one to set aside all personal *kudos*, and to aim at putting on the Board men of great capacity, with strong and broad views, and as far as possible possessing special qualifications to guide and direct a large gas undertaking such as that at Dublin.

One would have liked to see the report by Messrs. Herring and Newbigging; and I think stockholders are entitled to the knowledge of the full contents at this moment.

There is one personal matter before I conclude this letter. I owe to you, Sir, very sincere thanks for the courtesy and patience with which you have treated my communications under a *nom-de-plume*. I sometimes felt it would have been better to have written over my name. For very many years, however, it has been my practice to use this method in contributing articles or letters on abstract questions; but from now I have decided to abandon this particular *nom-de-plume*, which I do with much regret, and for the last time subscribe myself

"NONULUS," or R. W. EDWARDS.

Brooklands, Aldershot, March 21, 1914.

High-Pressure Gas-Mains.

SIR,—I note that, in your last issue, you invite particulars from towns possessing high-pressure gas-mains; and I have pleasure in giving the following information respecting Mossley.

We have a 6-inch main laid from the works, a distance of 4200 yards, through which gas is supplied at pressures ranging from 2 lbs. to 4 lbs. per square inch, for the supply of the main portion of the Saddleworth district. This main has replaced a low-pressure trunk-main which was of insufficient capacity, and also was in a very unsound condition. The gas is reduced by means of Reynolds and Crawford governors to a pressure of 3 inches in the districts of Uppermill and Dobcross; a few isolated services also being taken off the high-pressure main, and the pressure reduced by means of service governors. The maximum output per hour amounts to 24,000 cubic feet. The compressors are of the Bryan-Donkin Company's make, and are twin compressing sets, driven by enclosed type vertical steam-engines—a duplicate compressing set being provided for stand-by purposes.

About 2600 yards of the main were laid with Mannesmann steel tubes fitted with rigid joints and jointed with lead wool. Before the pipes were buried, a test pressure of 65 lbs. of air per square inch was applied, and was maintained for several hours without any practical loss of pressure. The final 1600 yards of main was laid with butt-welded joints; and this length was subjected to higher pressures with gas as the medium. The final 500 yards of welded main was blanked-off and a pressure of 100 lbs. of gas applied. This pressure was maintained for thirty-six hours without any drop on the gauge. After this test the 500 yards was passed as being sound.

It may be of interest to know that a butt-welded joint on a 3-inch pipe which was subjected to a tensile strain in a testing machine, stood a pressure of 20 tons per sectional square inch of the metal before failing.

The welding of steel tubes by means of the oxy-acetylene flame requires considerable care and skill by the operator; but when these are provided, I am quite satisfied the results which may be obtained are such as are little short of perfection for all practical purposes.

My personal experience leads me to the conviction that the use of sleeves in conjunction with the welding of steel tubes is unnecessary, and that equally good results are obtainable by butt-welding.

JAS. TAYLOR, Engineer and Manager.

Mossley Corporation Gas-Works, March 19, 1914.

REGISTER OF PATENTS.

Converting Animal Substances into Ammonia and Combustible Gases.

SMITH, A. T., of Abchurch Lane, E.C.

No. 5348; March 3, 1913.

The object of this invention is to obtain simultaneously from coal or coke, and from such animal substances as waste or scrap leather, almost all their contained nitrogen in the form of ammonia gas, and to separate the total ammonia gas by absorption in a liquor containing a small proportion of free sulphuric acid or other suitable substance in one single operation; and instead of expending fuel to make a dry distillation of such animal substances, to make their carbonaceous contents assist in the production of producer gas, which can be applied to external work—as heating furnaces or producing power in gas-engines in the known manner.

The invention is carried out by mixing the animal substances (preferably reduced to small pieces) with coal, slack, or coke, and lime, or limestone, and charging the mixture into any of the usual types of gas-producers constructed to be worked with a supply of mixed air and steam. The animal substances will be burned by the admixed air and steam, and the nascent and free hydrogen gas produced from the steam in conjunction with the comparatively high temperature will at once convert the contained nitrogen into ammonia.

Detectors of Combustible Gases.

PHILIP, A., and STEELE, L. J., of Portsmouth.

No. 5467; March 4, 1913.

This invention relates to detectors of combustible gases which depend for their action upon the activity of catalytic material; and it is particularly concerned with detectors of the kind in which the catalytic material is in the form of a wire, or is heated electrically by a current through a wire. The change of resistance in the wire resulting from increased heating when combustible gas is present is detected by a galvanometer or other indicator. For example, an active and inactive wire may be arranged in parallel—each in series with one winding of a differential galvanometer—or may form arms of a Wheatstone bridge joined to a battery and galvanometer in known manner.

Inverted Incandescent Gas-Burners.

EVERED and Co., LIMITED, and BOXALL, J. E., of Smethwick.

No. 7036; March 25, 1913. No. 19,797; Sept. 2, 1913.

This combined invention relates to inverted incandescent gas-burners of the type having a flanged cone-like tubular part of china or other refractory material surrounding the mixing-tube of the burner, and constituting the diffuser or deflector for the heated air and products of combustion arising from the incandescent mantle, which is carried by the steatite support arranged at the lower end of the mixing-tube and below the diffuser.

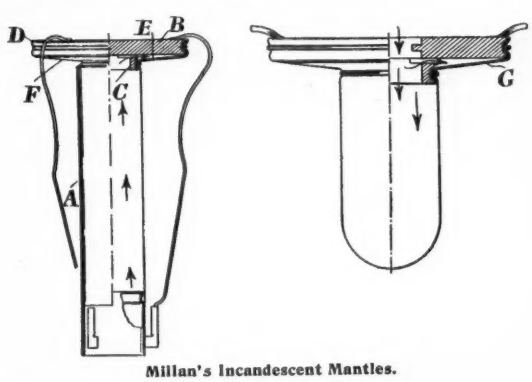
At or near the upper end of the mixing-tube of the burner is a preferably readily detachable and tubular or ring-like part, and on the upper flanged end of the diffuser is provided a tubular extension or socket; the ring-like part on the burner-tube and the socket or tubular extension of the porcelain or like diffuser fitting together when the parts of the burner are in position. Means are also provided for retaining the readily detachable diffuser or deflector in position on the burner or mixing-tube.

Incandescent Gas-Mantles.

MILLAN, A. F., of Mannington, West Virginia, U.S.A.

No. 9862; April 26, 1913.

This invention has for its object "the provision of means in connection with a gas-mantle for increasing the light, and for concentrating the rays beneath the source of light."



Millan's Incandescent Mantles.

The upright or vertical mantle A first shown is cylindrical, and open at both ends. A ring or disc B of suitable material is connected to the upper end. A second smaller ring is arranged below. The mantle extends over the latter ring, and is secured to it by a wire or other flexible member. The mantle is slightly constricted at the lower ring, but is enlarged above it, as at D, to fit over the ring B. The portion

of the mantle above the lower edge of the ring C is doubled, as shown at E, and this doubled portion extends from the upper face of the ring B to the lower face of the ring C. At its lower end, the mantle fits over the usual perforated cap. The portion F of the mantle is almost at right angles to the main body of the mantle, and the heat is thus reflected by this portion downwardly alongside the body of the mantle. The mantle is thus "heated to a higher temperature than would otherwise be the case, and becomes more luminous; in addition, the light rays are concentrated downwardly, and are not dissipated laterally and upwardly, as in the ordinary mantle."

In the inverted mantle also shown, the upper end (as before) fits over a ring and is doubled, as shown at G; the doubled portion extending from the lower face of the smaller ring to the upper face of the larger one.

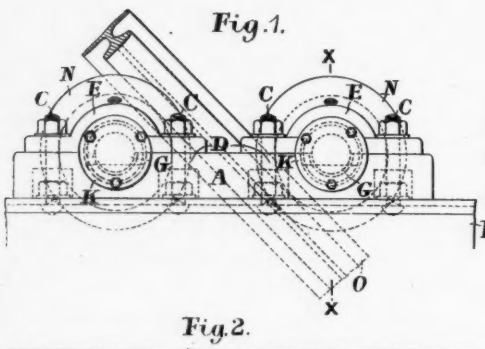
The patentee remarks: Combustion takes place around the mantle; but the solid extension of the ring at the upper end of the mantle deflects the heat downwardly—thus increasing the heat on the body of the mantle, and making the body more luminous. All that portion of the mantle beneath the upper ring is also luminous; and the rays of light pass downward. The upper ring is, in effect, a luminous baffle-plate, or a luminous reflector, for reflecting both heat and light rays downwardly. All heat and light rays passing upward are, in the present invention, "caught and utilized by the luminous reflector, and that portion of the mantle directly beneath the ring is luminous, when the mantle is in use."

Roller-Carriages for Spirally-Guided Gasholders.

MILBOURNE, R. J., of Muxton, near Newport, Salop.

No. 11,116; May 10, 1913.

This invention is intended to provide means whereby lubrication is automatically and efficiently effected, the free expansion and contraction of the gasholder is permitted, the removal of the rollers or carriages at any time is facilitated, and a dust-proof construction is secured.



Milbourne's Roller-Carriages and Lubricators for Spiral Gasholders.

Fig. 1 is a side view of the roller-carriage referred to. Fig. 2 is a plan. Fig. 3 is a section on the line X. Fig. 4 is a section on the line Y.

A is the carriage secured to the tank pier B or channel-iron grip of the holder by holding-down bolts C. D are the lower halves of the axle-bearing blocks provided on the carriage; and E are covers which provide the upper halves of the bearings, and which are secured in place by the bolts. F is a deep channel or hollow at the centre of each bearing, which thus constitutes an annular chamber serving as a reservoir for oil. G are the axles and H are the collars which (when the axles are in place) are inside the chambers F. I are the recesses or cups formed in the periphery of each collar H, and which, as the axle rotates, dips into the lubricant in the bottom part of the recess F. J are channels formed in the surface of each axle E, and extending from the cells or recesses in the collar. Thus, as the axle rotates in its bearing, the cells I pick up lubricant, which flows into the channels J in the axle, so that the whole surface is "efficiently lubricated."

K is a plate (preferably steel) which covers the outer end of the bearing so as to render it oil-tight—L being a felt packing pad which is inserted between the plate and the bearing end. At the other end of the bearing there is groove M, in which is fitted a piece of leather which is pressed against the axle G, so as to prevent the leakage of oil at that end of the bearing.

N are rollers, one of which is fixed upon each of the axles G, and which are designed to run upon the upper and lower parts of the spiral guide-rail O. The rollers are fixed upon the axle G, and cause them to rotate as the holder moves up or down. These rollers are formed with deep flanges to ensure their remaining in engagement with the H-section guide of the holder; and they are mounted upon reduced ends of the axles, to which they are secured by segmental washers or locking plates P, which are attached to the rollers by set-screws and are inserted in a groove or neck Q upon the end of the axle.

As stated, the groove F in each of the axle bearings is wider than the axle collar H, so that the latter has play within the bearing to enable the axle to follow the expansion and contraction of the holder. In practice the collar is so arranged upon the axle that it will come laterally into contact with the face of the bearing before the boss of the roller touches the bearing—thus ensuring that the part which is in frictional contact is the part which is constantly lubricated.

Regulating the Supply of Air and Gas to Burners, Cookers, Stoves, &c.

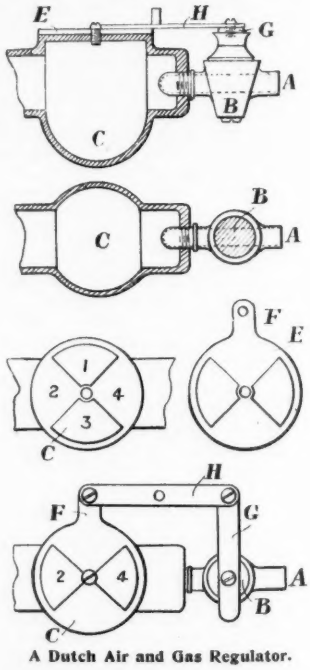
THOMSEN, P. F., LUII, J. A., DAM, W. J. van, and LASSCHUIT, P. T. A., of Haarlem, Holland.

No. 18,149; Aug. 9, 1913. Convention date, Jan. 8, 1913.

This invention relates to regulators of the type in which the quantity of air admitted depends upon, and is proportional to, the quantity of gas admitted—the air admitted from above into a mixing-chamber and the supplies of air and gas to the chamber being controlled by devices rotating about an axis perpendicular to the flow of gas and coupled together.

The illustration shows a side view with a partial section of the invention, with a section of the regulator of air and gas; also a plan of the partially covered chamber or compartment for the mixture of the air and gas, a detail of the revolving plate which covers the mixing-chamber, and a plan of the arrangement entirely mounted.

The gas passes through A to the chamber C through a cock B to turn off the supply. The chamber is partially covered by the sectors 2 and 4, and the air is admitted through the sectors 1 and 3. A revolving plate E (divided in sectors according to the corresponding sectors of the air chamber) is fixed by a screw K in the middle of the plate in



A Dutch Air and Gas Regulator.

such a way that it can be turned. The plate has a projection F, which is joined to the arm G by a bar H, and the arm is fitted to the cock.

By this arrangement the maximum supply of air takes place at the same time as the maximum supply of gas; the supply of air is completely shut off when the supply of gas ceases; and the intervening positions of the cock, relative to the corresponding openings or sectors for the supply of air, are always proportional to the supply of gas.

The Blackburn Gas-Workers' Troubles.

With further reference to the allegations made by certain members of the National Union of Gas Workers as to unnecessary delay in the reinstatement of workmen who took part in the recent municipal strike, Mr. Fleming Eccles (Assistant General Secretary of the Lancashire district) and Councillor Porter (Secretary of the Blackburn branch) had an interview early last week with Mr. Lewis Beard, the Town Clerk of the borough, and furnished that gentleman with the names of 46 men still awaiting reinstatement. The Town Clerk promised immediate attention to the question. On Friday evening, a statement was issued by the Corporation in which it was pointed out that of the 46 men four had since been taken on by the Corporation, and one could not be identified. Of the remaining 41, 35 were men whose work was either temporary or seasonal, or who, through slackness of work, could not at the moment be employed. Four had been displaced by re-organization or re-arrangement of work, one was not in the employment of the Corporation at the time of the strike, and the remaining one was receiving consideration. Of the men whose employment has been of a temporary or seasonal character, or who were now out of work through slackness, it was hoped that the greater part, if not all, would be employed again this year.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Private Bills:—

The Glasgow Corporation (Water, Tramways, &c.) Bill and the Manchester Corporation Bill were read a second time and committed.

The Abertillery Water Board Bill was reported with amendments.

Against the Glasgow Corporation (Water, Tramways, &c.) Bill have been presented 50 petitions, including County Councils, Corporations, Railway and other companies, and owners of private property.

The Examiners reported that the Standing Orders have not been complied with in respect of the petition for additional provision in the Hightown Gas and Electricity Bill.

The Select Committees on the Reading Corporation Bill, Cleckheaton Urban District Council Bill, and the Stone Gas and Electricity Bill reported that they had not proceeded with the consideration of the Bills, no parties having appeared in opposition to them. The Bills were re-committed as unopposed.

The Chairman of Committees informed the House that opposition to the Rhymney and Aber Valleys Gas and Water Bill and the British Gas Company Bill had been withdrawn. The Bills were committed to the Unopposed Bills Committee.

HOUSE OF COMMONS.

The Sheffield Corporation Bill was read a second time and committed.

The Deal and Walmer Gas and Electricity Bill, which on the second reading was referred to the Examiners, has now been committed.

The following Bills were reported with amendments: Kidsgrove Gas; Riddings District Gas; Bedwas and Machen Urban District Council; Leyland Gas and Electricity (now "Leyland Gas Bill").

Petitions were presented for an additional provision in the Middlesbrough Corporation Bill and the South Suburban Gas Bill.

A petition was presented by the Carlow Rural District Council and the Carlow Board of Guardians praying to be heard against the Gas Provisional Order (No. 1) Bill.

The petition of the North Staffordshire Railway Company against the Kidsgrove Gas Bill was withdrawn.

The London County Council (General Powers) Bill has been referred to a Select Committee consisting of Sir Charles Nicholson, Sir Joseph Harmor, Mr. Shirley Benn, Mr. Primrose, Mr. Nicholson (Petersfield), Mr. Charles Price, and Mr. C. W. Bowerman.

The Deal and Walmer Gas and Electricity Bill, Wadhurst and District Gas Bill, Isle of Thanet Gas Bill, Tees Valley Water Bill, and South Suburban Gas Bill have been referred to a Committee consisting of Sir Harry Samuel, Mr. France, Mr. Orde-Powlett, and Mr. Robinson, to commence sitting on Tuesday, March 31.

Additional Provision in the South Suburban Bill.

The additional provision in this Bill for which a petition has been presented is for an extension of the limits of supply of the Company by inclusion of part of the parish of Shoreham; the application thereto of powers, duties, &c., applicable to existing limits of supply; power to break-up streets, &c.; special provisions as to the price of gas in the added area—the special price in the added area and in certain other districts not to be taken into account in calculating the rate of dividend on ordinary stock; provisions as to calorific value of gas supplied in the added area; exclusion of enactments relating to illuminating power; and the incorporation, application, repeal, and amendment of Acts.

Middlesbrough Corporation Bill.

The additional provision in this Bill, for which a petition has been presented, merely seeks to include the rural parish of Hemlington within the Corporation's gas limits.

BRENTFORD GAS BILL.

Adjustment of Clauses.

HOUSE OF LORDS—Monday, March 16.

(*Before* LORD HYLTON'S *Committee.*)

Clauses in this Bill, the proceedings in which appeared in the last two issues of the "JOURNAL" (pp. 665-8 and 747-51), were gone through to-day.

The clauses relating to capital were adjusted so that the new capital is to be £310,000, with one-third borrowing powers.

Mr. JEEVES, for the Twickenham Council, referring to the special purposes fund, asked whether the Committee's decision on the preamble gave the Company the right to set aside ½ per cent. for this purpose with respect to the converted capital, or was it to be restricted, as he had suggested in cross-examination, to the unconverted capital.

The CHAIRMAN said it was the intention of the Committee to grant the powers asked for in the Bill—viz., to set aside ½ per cent. on the converted capital.

With regard to the electricity clauses, several opponents asked for an alteration in the amended clause put in by the promoters. Under the Committee's decision, the Company are only to be allowed to apply for Electric Lighting Provisional Orders in districts where there are no authorized distributors. The clause now proposed empowered the Company to apply in districts where there is no supply "already." The alteration asked for was "at the time of the application." Eventually the promoters agreed to make the clause read that they will not apply for Provisional Orders in areas where there is an authorized distributor "at the time of such application."

Mr. PAGE, for the Hammersmith Borough Council, next asked that the promoters should not be allowed to apply for Electric Lighting Orders in districts adjoining their area of supply. Mr. Johnston had given an undertaking that he would not compete with any local authority, or combination of local authorities which could be formed under the Electric Lighting Act of 1909. Therefore the Company should not be allowed to apply for Orders in adjoining districts, as this might enable them to compete with such combinations of local authorities.

Mr. TALBOT said this matter did not interest Hammersmith at all. An undertaking had been given that the Company would not compete with any local authority or combination of local authorities; and this was carried out in the clause giving the Company the right to apply to the Board of Trade for Electric Lighting Orders.

The CHAIRMAN said he could not give more nor less than was intended by Mr. Johnston's undertaking and by the Committee's decision.

Mr. BROWNE (Messrs. Dyson and Co., Parliamentary Agents), on behalf of the Metropolitan Electric Supply Company, asked if the Committee had come to any decision as to the right of the Brentford Gas Company to acquire electrical undertakings.

Mr. TALBOT said this was precisely the point which Mr. Balfour Browne had argued for the Electric Supply Company—viz., that the Gas Company should not be allowed to have the option of purchasing an electric supply undertaking. He apprehended that the Committee had considered this point on the preamble. He thought the point had been disposed of in favour of the promoters.

The CHAIRMAN agreed that this was so.

Mr. JEEVES and Mr. SZLUMPER, for the Twickenham and Richmond Local Authorities, asked for special exemption of their areas from the operation of this clause.

The CHAIRMAN, however, refused to grant it.

Mr. PAGE, for the Hammersmith Borough Council, asked that the Company should be prohibited from laying pipes for conveying residuals over a larger area than half-a-mile radius from any gas-works, similarly to what was decided in the case of the supply of power gas. He maintained that the promoters had agreed to this in the course of the proceedings.

After some discussion, the promoters agreed to this, but could not agree to the radius extending only from the gas-works. They desired it to apply to lands where residuals were stored.

The CHAIRMAN decided that what applied to power gas—viz., a radius of half-a-mile from any gas-works—must also apply to the residual pipes.

Mr. SZLUMPER, for the Richmond Corporation, wished to be excluded from the half-mile clause, as part of the Borough of Richmond would come within the limit.

The application was refused.

A very long discussion took place with regard to testing-stations. During the course of the proceedings, Mr. Johnston had agreed that there should be testing-stations on the trunk mains supplying the north and west districts—limiting the number to two stations. Mr. Jeeves, for the Twickenham and Heston Councils, called attention to the fact that no clause had been submitted by the promoters to deal with this; his claim being that there should be two new testing-stations erected. The promoters disagreed with this view, and argued that there were at present testing-stations at Brentford and Southall, and that these would be maintained so long as the works were in existence. The only necessity for putting a clause in the Bill to this effect was that the testing-station at Southall was not a statutory one. Mr. Jeeves, however, asked the Chairman to specify the places where two new stations should be erected. They should, he said, be a convenient distance away from the works, in order that the gas being supplied to the various districts should be properly tested.

The CHAIRMAN said he could not do this. Having obtained the undertaking from the promoters that they would maintain testing-stations on their north and west trunk mains, Mr. Jeeves had better make the best terms he could with the promoters. If an agreement could be come to as to where the stations should be, it could be put in the Bill.

Mr. TALBOT dissented from the view that the Company had undertaken to erect two new testing-stations, and called evidence on the point.

Mr. *A. A. Johnston*, the Chief Engineer to the Brentford Gas Company, said it would be impossible to have separate testing-stations away from the works, as, immediately the gas left the works, it branched off into a number of mains. It was because of this that he considered a testing-station at the works in each case to be sufficient. This was what he had intended when he gave the undertaking to have two testing-stations—one on the trunk main supplying the smaller mains going to the north district, and one on the trunk main supplying the smaller mains going to the west district.

The CHAIRMAN pointed out that the Company would then be in the position of discontinuing one or other of their works, and thus reducing the number of testing-stations. He thought there must be two testing-stations permanently maintained.

The discussion went on more or less in a circle for a very considerable time. Eventually,

The CHAIRMAN intimated to both parties that he was being put to a considerable amount of unnecessary inconvenience, and expressed his dissatisfaction that Counsel should have come to an agreement three or four days ago, and now found themselves unable to carry out the agreement. Finally, a clause to the following effect was arranged:

> The Company shall at all times maintain a testing-place and all proper apparatus for testing all gas manufactured at, and supplied from, the works of the Company other than the works of the Company at Staines and Sunbury.

Mr. JEEVES pointed out that this did not at all carry out the undertaking which the Company had given; but in view of the protracted discussion he would say no more about the matter then.

On the question of public lighting, Counsel on behalf of several local authorities pointed out that the lowest price charged for public lighting was 1s. 9½d. per 1000 cubic feet. This represented a difference of 23·2 per cent. below the price charged to the ordinary consumers. It was asked, therefore, that the clause dealing with public lighting should read that the difference between the price charged to the ordi-

nary consumer and that charged for public lighting should never be less than 23·2 per cent.

Mr. TALBOT pointed out, however, that the price of public lighting varied according to the length of the contract. He could only agree to maintaining the existing difference in each particular case.

The CHAIRMAN agreed to the insertion of the following clause:

> Provided that the price of gas supplied for public lighting shall bear the same proportion to the price at which the rate of dividend authorized is determined as at the date of the passing of this Act.

On the application of Mr. SZLUMPER, for the Richmond Corporation, the promoters agreed to the insertion of the Swansea stand-by clause.

Mr. JEEVES finally asked for the insertion of a clause whereby, in the case of private roads, the local authority should be allowed to specify the depth at which mains are to be laid, the distance being not less than 2 feet nor more than 2 ft. 6 in. A clause to this effect was in the Wandsworth Gas Act; and he asked that a proviso to this effect should be added to clause 88 in this case.

Mr. TALBOT resisted the proviso as being unreasonable.

The CHAIRMAN: I do not think I can put that in.

The Bill was then ordered to be reported for third reading.

LEYLAND GAS AND ELECTRICITY BILL.

HOUSE OF COMMONS COMMITTEE.—Tuesday, March 17.

(*Before Mr.* MOUNT, *Chairman, Mr.* PRATT, *Mr.* J. WOOD, *and Mr.* J. W. S. M'LAREN.)

The objects of this Bill, promoted by the Leyland and District Gas Company, are to extend the limits of supply, to construct new works, authorize the use of certain lands for gas purposes, substitute a calorific for an illuminating power test, to sanction electrical powers, and to authorize additional capital.

Mr. HONORATUS LLOYD, K.C., and Mr. JACQUES ABADY appeared for the promoters. The opponents were the Leyland Urban District Council, represented by Mr. G. J. TALBOT, K.C., and Mr. TYLDESLEY JONES, and the West Lancashire Rural District Council, represented by Mr. J. W. JEEVES.

Mr. HONORATUS LLOYD, in opening, said the Leyland and District Gas Company was registered in 1856 as a non-statutory Company, but were granted statutory powers in 1863. The authorized share capital then was £10,000 of 10 per cent. maximum stock and £2500 of loan capital. In those days, however, it was not unusual to allow a company to substitute share capital for loan capital. Thus it was that the Company had raised £1400 of their loan capital as 10 per cent. stock and £1000 on 5 per cent. preference shares, with the right to participate in any surplus with the ordinary shares when 5 per cent. had been paid on the ordinary shares. The Company's next Act was in 1902, when the capital was converted from 10 per cent. into 5 per cent. stock; and, of course, the nominal value was at the same time doubled. Therefore the £12,400 which had been issued became £24,800 of 5 per cent. stock. The capital was also at the same time increased by £40,000 share capital and one-quarter borrowing powers. In 1909 the Company were again before Parliament, when the area of supply was extended and further capital powers to the extent of £5000 authorized, with one-quarter borrowing powers. Under the 1909 Act also, the Company became a sliding-scale Company, with a standard dividend of 5 per cent. and a standard price of 3s. 10d. Summing up the capital powers, Counsel said that the share capital authorized was £69,800, of which £40,136 had been raised; leaving £29,664 unissued. There was, in addition, loan capital of £11,250 unissued; making a total of £40,914 unissued capital. The Company's present district comprised Leyland and a number of outside parishes; and it was now proposed to add another five parishes. In certain districts of the present area gas was not supplied by the Company. The reason for this was that another authority had equal powers to supply; and an agreement had been come to by which the other authority exercised its powers. It had also been originally intended to add Longton to the Company's area; but when it was found that the Preston Gas Company were supplying there, the district was cut out of the Bill. The Company's present area, however, was developing at a very rapid rate, and would continue to do so, on account of the growing industrial nature of the district, where there were now many rubber and motor factories. The quantity of gas supplied had doubled itself during the past nine years, and now over 60 million cubic feet per annum were sold. The works were considerably congested, and were situated in a very awkward bend of the road which the road authority had been desirous for some time of doing away with. The new land on the other side of the works which the Company wished to acquire would allow of this being done. The next important object of the Bill was with regard to the calorific power test. Clauses had been inserted dealing with this; but in view of what was taking place in connection with the Gas Light and Coke Company's Bill, it would perhaps be better not to discuss this matter before the Committee, and to abide by whatever decision was come to in that case. If the opponents objected, of course, they must fight the question of principle out at the expense of the Leyland Company.

Mr. JEEVES, for the West Lancashire Rural District Council, said he desired the exclusion of Hesketh and Tarleton from the proposed new area. His case would proceed on these lines.

Mr. TYLDESLEY JONES, for the Leyland Urban District Council, said, assuming the Bill proceeded, he would not want to fight the question before the Committee, provided the promoters accepted the ultimate decision in the Gas Light and Coke Company's Bill.

Mr. HONORATUS LLOYD said that all he would say with regard to the matter therefore was that figures had been inserted in the Bill making the British thermal units 540 gross and 475 net—these being the figures which had been hitherto accepted. Continuing, Counsel dealt with the electricity powers. Objection was taken to a gas company having electricity powers; it being said that the object was foul, and that the powers would be used to restrict or even prevent competition with gas. The real reason, however, was that at a gas-works there was a considerable amount of waste heat which in a small district could be used economically for the generation of electricity; and evidence would be given that this was being done in several places. He could not understand why the Leyland District Council should object, seeing that they had an Electric Lighting Order which had been allowed to lapse. There was an undoubted demand for electricity; and the Gas Company now asked to be allowed to meet it. A clause had been agreed with the Lancashire Electric Power Company who had bulk supply powers in the area. Coming to the additional capital, the Bill as originally introduced contained powers in this direction which he could not justify; the sum being far more than was usually granted by Parliament. Originally, the Bill asked for £60,000, with one-third borrowing powers; making £80,000 in all. It was now proposed to ask for £70,000 for gas purposes and £17,600 for electricity purposes, which, together with £4000 for parliamentary costs, made a total of £91,600. The total unexercised capital powers were £40,914. The Company had also spent £6842 on capital account not yet issued, which must be deducted from the £40 914; leaving £34,071 to be deducted from the £91,600. What it was proposed to ask the Committee to do was to allow £40,000 new capital, *plus* one-third borrowing powers (making £53,333), and, in addition, to be allowed to borrow to the extent of one-third instead of one-fourth of the existing capital, giving a further £3750, and making a grand total of £57,083. If the electricity powers were not granted, of course, the amount would be reduced by £17,600. In conclusion, reference was made to clause 39 of the Bill which was as follows:

> For the purpose of section 29 of the Act of 1909, the price charged by the Company in any year shall be deemed to be the average of the prices per 1000 cubic feet charged by the Company in respect of all gas supplied by them during such year.

The clause was neither convenient nor desirable; and he did not propose to proceed with it. He did not know who drafted it. It was quite a novel proposal, and had never been seen on any Bill before. There were two petitions against the Bill—the Leyland Urban District Council and the West Lancashire Rural District Council. Taking the former first, the Council alleged that the Company had considered the shareholders more than the gas consumers in the past; and complaint was made that the price was too high. On this point, Counsel reminded the Committee that the Company were a sliding-scale company. Another allegation was that the works were not up to date. This was denied. He agreed that a new retort-house was required, and one would have been built were it not for the existence of the awkward corner already referred to, which a new retort-house on this spot would have perpetuated. As a matter of fact, a temporary retort-house had been erected over the coal-store, and was working quite efficiently, as were the whole of the works. Furthermore, the plant was working to its full output, and there was not, as was suggested, further capacity available. In this connection, it was right for him to tell the Committee that Mr. Stevenson, the Engineer for the Council, had been refused permission to inspect the Company's works. Counsel admitted that this was a grave mistake, and he must bear the prejudice of it. Complaint was also made of nuisance—a thing which had never been heard of before by the Company. From this the Council went on to say in their petition that the dilatory and selfish methods hitherto adopted by the Company should warrant the Committee giving careful consideration to the question of the Council purchasing the undertaking. The Company, however, did not wish to sell; and it was uncommon for Parliament to allow a statutory company to be compulsorily purchased unless grave neglect of duty could be shown, which he maintained was not the case here. Indeed, it had never been done where the company were doing their duty. Exception was also taken by the Council to the proposed electricity powers, as well as to the capital powers, even as modified. He agreed that there was something in the allegation that during recent years items which should have been charged to capital had been charged to revenue, because certain mains and also the retort-house had been charged to revenue and not capital, as no doubt they should have been. Finally, Counsel mentioned a clause in the petition that the Company had not done what they should have done in reinstating the roads. The fact was, however, that the Council actually did the reinstating, and the Company paid whatever was charged. The opposition of the West Lancashire Rural District Council was in order to obtain exclusion from the proposed new area of the districts of Tarleton and Hesketh-with-Becconsall. A report had been presented by the Board of Trade pointing out that the clause relating to electricity agreements was unnecessary, inasmuch as the Lancashire Power Company already had authority to give a supply in bulk; while the Leyland Company would have powers to take a supply in bulk under the Electric Lighting Act of 1909, if the Committee now gave the Gas Company authority to supply electricity in Leyland.

Mr. *Francis Elliott*, the Manager of the Leyland Gas Company, examined by Mr. ABADY, said that the works were quite modern, and were working to their full capacity. The average rate of increase in the output of the works was about 8 per cent. per annum. There was large scope for further development in the district. Building operations were going on at a considerable rate; but at present a very large number of people who worked in Leyland were forced to live in other districts. The output in 1904 was 32 million cubic feet, whereas in 1913 it was 64 millions. The sales per mile of main were 2½ million feet per annum. The estimated capital expenditure was £70,000 for gas purposes, including £4000 for land and £18,500 for a new retort-house, benches, and coal-handling plant. On the question of road openings and nuisance from the works, he denied that there had ever been any complaints. The charges for gas were now 2s. to 2s. 8d. for power purposes, 2s. 10d. for public lighting, and 3s. to ordinary consumers. There had been two reductions since 1909.

In cross-examination by Mr. JEEVES, witness said the existing area was about 32 square miles; whereas under the Bill the area would be practically doubled. He agreed that the bulk of the supply given by the Company was in Leyland; but he did not agree that there was a large part of Leyland in which there were no mains. Counsel's point was that the Company, in coming into the West Lancashire Rural

District Council's area, were coming across a river and into a district with which they at present had no connection. Witness said, however, that a 4-inch high-pressure main was already within 4 miles of the new area. The works of the Company were some seven miles away from the West Lancashire district; and the Rural District Council feared that this distance was too far for consumers to travel if complaints had to be made to the Company.

Mr. HONORATUS LLOYD, for the promoters, suggested that there were such things as telephones and the post.

Witness, in answer to further questions, said that the cost of extending the 4-inch high-pressure main to the West Lancashire boundary would be £1000 to £1500. In spite of this expense, however, it was only proposed to charge for gas the same rate as in Leyland.

Mr. TALBOT, for the Leyland Council, put it to witness that during the past fifty years the Company had spent £40,000; whereas the new capital powers now asked were over £91,000. The new works, said witness, would enable a total output of a million cubic feet per day; and this was the development anticipated in the next fifteen years During the past five years, the capital expenditure per million was £310; and Counsel suggested that, on this basis, the capital powers now asked for would carry the Company on to the next century. Other questions were directed to showing that at present there were a large number of retorts not in use, and that there was no need to enlarge the works having regard also to what was alleged to be the slow increase in the population. On the question raised in the Council's petition, that the Company were not properly carrying on the undertaking, Counsel referred to the charge made to slot consumers, which it was said was more than should be charged under the Company's Act. It was also said that the Company's policy was to refuse to connect ordinary consumers, and to force the use of slot meters upon those applying for a supply. All this was strongly denied by witness, who, however, agreed that the charge to the slot-meter consumer had gradually gone up from 5d. to 7d., and now it was 9d., extra compared with the ordinary charge of 3s.

In re-examination, witness said the Company were authorized to charge 10d. per 1000 cubic feet extra for slot meters with fittings and cooker. This price, however, was not actually charged; but an all-round figure of 9d. extra was charged, whether a cooker was supplied or not.

Mr. *William Cash* confirmed the figures of capital already given by Mr. Honoratus Lloyd in opening. An expenditure of £1150 had been made on mains during the past two years and charged to revenue. In regard to this, however, the Company had not charged anything to depreciation. The net result would have made very little difference if this had been done and the other expenditure charged to capital.

In cross-examination, witness said he did not think this was to the disadvantage of the consumer. He agreed that the mains should be charged to capital. As to meters, however, it did not matter much if nothing was charged for depreciation. In the case of the retorts charged to revenue, the justification for this was that the work was of a temporary character. Dealing with the question of the purchase of the Company's undertaking, witness thought there was a tendency for this to react on the consumer, having regard to the terms on which such purchases were usually made.

Mr. *Samuel Tagg*, the Engineer and Manager to the Preston Gas Company, said the Leyland Company's works were a very well laid-out works having regard to the plant. There were 58 retorts, consisting of 24 beds of sevens and two beds of eights. The latter were put in as a temporary works. The area of land at the works was only sufficient for present purposes, and it was not economical to extend on the existing site. Even if it were possible to do so, it would be very unwise, owing to the awkward position in which the works were situated. The industrial development in Leyland during the past five years was responsible for the development of the gas demand at an abnormal rate.

Mr. HONORATUS LLOYD mentioned that no cross-examination of the previous witnesses had taken place as to alleged nuisance.

Witness remarked that he had never noticed any nuisance from the works. Continuing, he said he agreed with the estimates put in by the Manager of the Leyland Company. The cost of the supply to the proposed new areas was estimated at £10,200—£4830 for works and £5400 for mains. He regarded the new area as likely to be very remunerative districts.

Cross-examined by Mr. TALBOT, witness said he anticipated a supply of 10 million cubic feet per annum in the new area when the mains were laid.

Wednesday, March 18.

The first witness called this morning was,

Mr. *Henry Woodall*, who said the Leyland works were good considering their size; but it was very desirable to have a larger area for the works than was available at present. The new land now proposed to be taken would enable the Company not only to extend the gas-works, but also to instal plant for generating electricity on very economical terms, and certainly on better terms than could be offered by the Council or any independent electric supply company. He estimated that during the next twelve years it would be necessary to provide plant for an additional 100 million cubic feet of gas per annum; and the usual figure of £750 per million showed that the capital asked for was quite a reasonable amount. On the question of purchase of gas undertakings, it was his experience that Parliament never gave a purchase clause to local authorities in the case of statutory undertakings unless it had been proved that the Company had been negligent in carrying out their duties.

In cross-examination by Mr. TALBOT, on behalf of the Leyland Council, witness agreed that the Company might have been more liberal in their treatment of the prepayment consumer. At the same time, prior to the slot consumer paying 9d. extra compared with the ordinary consumer, he considered the slot consumer was being treated too liberally. On the other hand, the ordinary consumer was not charged meter-rent. This demonstrated that the Company were not out merely to pay high dividends. As to the works, he understood the scheme was to gradually replace the existing works by a new one on the proposed site adjoining the present one.

Mr. JEEVES, for the West Lancashire Rural District Council, in his cross-examination, put it that the inhabitants of Hesketh and Tarleton —districts which it was asked should be excluded—did not want gas. When a supply was required, it could be more easily given by other gas authorities on the Western border of the area, as all the development was taking place in that direction and away from the Leyland Company's existing area. Witness, however, argued that there was a demand in this district, and that this extra demand would tend to decrease the costs of manufacture all round. This had been the experience when the Company went to Heskin, 9 miles away from the works. Tarleton was only 8 miles away, and was a similar district.

In answer to the COMMITTEE, witness said he was at present concerned with two gas companies who were building electricity works—viz., Tottenham and Herne Bay.

Mr. *A. H. Dykes*, consulting electrical engineer, said that he had advised the Farnham and Ascot Gas Companies in regard to electrical undertakings. Electricity supply would undoubtedly be required for power purposes for such a manufacturing district as Leyland was rapidly becoming—indeed, this would be more important than supply for lighting. There were at present 1450 K.W. of private plants installed in works at Leyland, which were necessarily not supplying under the most economical conditions. Inquiries showed that the works would be willing to take current from the Gas Company. It was intended to use coke in producer-gas plant for driving the electric generators; and there was little doubt that the Gas Company could supply at a cheaper rate than could a small private plant. Another advantageous factor in Leyland was that the works were all close to the gas-works. The distribution costs would therefore be very low—due to the small amount of mains which it would be necessary to lay. Three-phase high-tension distribution would be adopted, to be transformed to any required voltage, exactly similar to the Farnham installation, which was put in eighteen months ago and was working very satisfactorily. In all cases where gas companies had undertaken electricity supply, it had been found possible to actually reduce the cost of gas manufacture, and, curiously enough, in spite of the electricity supply, the demand for gas had increased—evidence that competition had not been stifled. In addition, the price of gas had been reduced. He spoke from his own experience of these matters at Ascot and Farnham. He would put down a 400 K.W. plant at Leyland at the start; and he anticipated a load of this amount immediately. The load factor should be 25 per cent.; and the capital outlay would be £18,150. The increase compared with the amount of money asked for in the Bill for electricity was due to Post Office requirements for protecting from high-tension mains the telephone and telegraph wires. He calculated an annual output of 876,000 units at an average price of 1·1d. per unit. He did not anticipate a large demand for electricity for lighting from private houses unless some fixed-price system were adopted, as most of the houses in Leyland were occupied by people of the working class.

Mr. TYLDESLEY JONES, in his cross-examination for the Leyland Council, pointed out that at Ascot, Farnham, and Bognor, Mr. Dykes had advised the use of Diesel engines, and did not use coke. Witness said the companies could in those cases get a better price for the coke than burning it in a producer plant. He agreed that he could not point to any works of this size which were able to sell current at 1·1d. per unit; but he had calculated this price having regard to the nature of the district. It was put to witness that the Lancashire Electric Power Company were supplying in some districts at 2d. per unit; but he said he was not at all sure that the Gas Company could not supply at this price under similar circumstances as to load. There was considerable discussion as to the fixed-price light system of supplying electricity. Witness maintained that this was particularly applicable to a district of small working-class houses such as Leyland.

In answer to the COMMITTEE, witness said the question of using oil or coke for generating electricity depended upon the market price of each. The nearest power station of the Lancashire Electric Power Company was thirty miles away from Leyland.

Mr. TYLDESLEY JONES said the Lancashire Company were now seeking powers to supply electricity in detail in Chorley, a contiguous area to Leyland.

This concluded the case for the Bill.

The CHAIRMAN said the Committee would not trouble the opponents to deal with the electricity proposals, as these could not be granted.

The case for the Leyland Urban District Council on the remaining portions of the Bill was then proceeded with.

Mr. *George Gregson*, the Chairman of the Highways Committee, said he had built a number of houses and had installed gas-fittings, paying for the fittings himself. Some of the houses were supplied with gas through penny slot meters and others through shilling slot meters. In all the houses he was aware of in which the Gas Company has provided fittings, these usually consisted of one fitting and perhaps a boiling ring. His own penny slot meter consumers were charged at the rate of 20 feet per penny, or 3s. 9d. per 1000 per cubic feet. The Council were desirous of buying the Company's undertaking. If the Committee inserted a provision that if the Council brought in a Bill for this purpose next session the Company should not oppose, this would meet the views of the Council. The purchase would be on arbitration terms; and therefore the insertion of a purchase clause could do the Company no harm.

Mr. HONORATUS LLOYD cross-examined to the effect that, although there was a complaint in the Council's petition as to nuisance, no letter had ever been written to the Company complaining. Witness, however, said that the Surveyor had been instructed to speak to the Manager of the Company on the matter. He did not provide cookers or boiling rings in the houses he had referred to. As to the complaints of bad road repairing, Counsel said that the Council had always done the reinstatement, and the Company paid. Witness did not agree, and said that this arrangement only came into force since last June.

Mr. *M. H. Wilkinson*, the Surveyor to the Leyland Urban District

Council, said there were 193 lamps in the district, all supplied with gas. He specially referred to nuisance at the gas-works from fumes due to quenching of coke. As to reinstatements, the Gas Company frequently did not give notice when they proposed to break-up the road. In addition to this, the Company very often, in reinstating the road, with the exception of the metal, filled in the trenches in a very bad manner, and the Local Authority was compelled to clear the trench in order to properly reinstate. In June, 1913, a new arrangement was come to for the Council to reinstate the roads; the price being increased. This difficulty of road reinstatement was one of the reasons why the Council thought the undertaking would be better in the hands of the Local Authority. He denied that the Company piped any of the new houses built in the district since he was appointed Surveyor. The owner of the house always did this.

Mr. HONORATUS LLOYD, in cross-examining, pointed out that 1d. in the pound produced £127, to which witness agreed. He had some idea of the cost of the purchase. He had reported to the Council as to the bad reinstatement of roads by the Gas Company, but did not remember whether the Council had officially complained. In reference to complaints as to the small amount of gas given by prepayment meters, Counsel remarked that the shilling slot meters were set to give 312 cubic feet of gas for 1s. Witness, however, said he had tested one or two and found them giving below this; but he would not go so far as to say that the Company were knowingly putting in meters which gave a less quantity than they were supposed to give. He had not tested the Company's gas for some years, because since the introduction of incandescent mantles in the district he had been satisfied with it.

By the CHAIRMAN: The Company had always met him fairly when he had made complaints.

A number of local witnesses were then called with regard to alleged grievances against the Company in the matter of the quantity of gas supplied by slot meters, and the fact that the Company do not always fix fittings free of charge in the case of slot-meter consumers. One witness alleged that the late Manager of the Company, in 1908, refused to instal an ordinary meter, with the result that witness was forced to accept a shilling slot meter. These witnesses also spoke to a general desire on the part of the ratepayers that the Council should purchase the Company's undertaking.

Mr. *R. Porter*, the Manager of the Elland Gas-Works, said that the proposed new area was a very unpromising one from the point of view of gas supply. The cost of distribution would be so high that it would react upon the consumer in Leyland. The best part of the district—and that was not very good—was Longton, which had been cut out of the proposed new area. He believed there were only 700 tenanted houses in the area, to supply which would require the laying of 15 miles of mains. Even so he did not believe the Company would get 50 per cent. of the houses, if they did not treat the consumers better than they were treated in Leyland. If they did, probably 70 per cent. would be obtained. Some time ago he surveyed the new area for the purpose of promoting a separate company; but he advised his clients against proceeding with the scheme. The works were good, up-to-date works of their kind; but he had only made a very hurried inspection of them. From this inspection, however, he had come to the conclusion that the works, as they stand, could be made capable of a very much larger output than the present. The new capital proposals were absurd. He had tenders in hand now for an exactly similar retort-house to that proposed under the Bill, capable of an output of 640,000 cubic feet per day, at a cost of £9500, including coal conveying plant. Dealing with the manner in which the Company had issued capital in the past—viz., by shares and not loans—witness said that a larger amount of premiums would have been obtained if some proportion of the loan capital had been issued. Quite recently the neighbouring Preston Company had sold 5 per cent. stock by auction, and had received an average of £122 per £100—the highest price being £126. Witness considered the sum charged to repairs too high, and consequently militated against the reduction of price. The excess amount charged against repairs during the past three years was put at £2423.

Mr. HONORATUS LLOYD asked what this would amount to if the sum had been charged to capital and interest paid on it for all time. He suggested that there would be a saving of £2020 on the one side and a loss of £3000 on the other.

Witness disagreed with the figure of £750 per million as capital expenditure on the new works, and referred to a number of places where the amount was much higher.

In cross-examination by Mr. HONORATUS LLOYD, witness said he agreed that the prices charged in Leyland were moderate. Coming to the complaints that had been made with regard to the high price for shilling slot-meters, Counsel put it that the cost of a meter was 45s., and that 10 per cent. on this was equal to something over 2d. per 1000 cubic feet, which was more than the Company were actually charging. Witness agreed, but added that many of the meters did not register the full amount for which they were set, and that to this extent, either wilfully or by negligence, the Company were obtaining more money from the slot consumers than they should. Counsel then put forward many figures which witness agreed showed that the average prices received from the consumers were: From the ordinary consumer, 3s. per 1000 cubic feet; from penny slot meters, 3s. 9d.; and from the shilling meters, 3s. 2d. Therefore, even if some consumers were charged too much, others were charged too little; and if the Company, as alleged, had been acting dishonestly, it had not brought a penny profit. Indeed, taking all classes of supply together, the Company received an average return of only 2s. 11d. per 1000 feet.

A long argument took place between witness and Mr. Honoratus Lloyd as to the amount to be charged for repairs, which witness said should be 6d. per 1000 cubic feet. Counsel put it that this was one of the most disputed figures among gas engineers, and proceeded to cross-examine witness to the point that too much had been set aside in this case for repairs, as stated in evidence in chief. The figures, however, showed that in previous years the amount was less than 4d.; so that the argument that there should have been 6d. in every year did no. apply. As a fact, the average amount set aside during the past five years had been 6¾d.; so that there was, said Counsel, very little to quarrel about, even assuming 6d. was the right figure to take.

Thursday, March 19.

Mr. *E. H. Stevenson* said he had made a special inspection of the district, but had not been allowed to see the works. He agreed that the Longton district, now cut out, was the only one that afforded a reasonable chance of profit, although he had had some doubt about it. Certainly the Hesketh and Tarleton districts would not take a sufficient supply to pay the interest on the capital expenditure in the area. In his opinion the existing gas lands were ample for an output of 750,000 to 800,000 cubic feet of gas per day, compared with the present output of 300,000 cubic feet. As to capital powers, he could not imagine a small company with so much as £30,000 or £40,000 unexpended capital coming to Parliament for additional capital powers. It was an extraordinary Bill; and he had never known one like it before. Reckoning the past rate of capital expenditure, the £74,000 new capital powers—which they were, now that the electricity powers had gone—would carry the Company on for 30 years. At the same time, the past rate of capital expenditure was abnormal; and the ordinary practice of Parliament was only to allow for 15 years' capital expenditure. He believed that the unexpended capital powers would carry the Company on for 12 years; and if the amounts charged to revenue in the past were continued, the Company could carry on for 15 years. His view was that the Bill was unnecessary; and the Council took the opportunity of asking purchase powers of the undertaking. There had been cases in which compulsory purchase clauses had been granted where no complaints had been made against the company. In this case, the circumstances were all in favour of the Council taking over the undertaking. Local authorities supplied gas much more cheaply than companies, and there was the further advantage that the Council having a gas undertaking maintained full control of the roads. The policy of the Company with regard to the shilling slot meters had been absolutely wrong. As an example of the way in which they had been pushed, instead of ordinary meters, he mentioned one consumer who took 40,000 cubic feet in fifteen months. Again, he knew from observation that the Company did not fit many houses with pipes or fittings. The average price received by the Company from ordinary consumers was 2s. 7½d. per 1000 cubic feet, and from prepayment consumers 3s. 5d. Usually a prepayment consumer received a meter rent free, four or five lights, and a griller or boiling ring.

Mr. HONORATUS LLOYD cross-examined to the effect that the retort-house was not in a good position. Witness agreed that it would be a good thing if it were shifted; but there was enough land available for this. He said the figure for repairs and maintenance should be 6d. There was no contention about this; the point of dispute among gas engineers was whether it should include depreciation. The average figure set aside by local authorities was about 5½d. per 1000 cubic feet. He did not suggest the purchase clause in this case; but it was a fact that it was not the general practice for Parliament to grant purchase clauses unless the company had given good grounds for complaint. All the Council wanted in this case was to prevent the Bill going forward. Then a substantial Purchase Bill would be brought in next session. He maintained that in this case there had been misconduct on the part of the Company.

The CHAIRMAN: You need not call further evidence as to purchase, Mr. Talbot.

Mr. TALBOT: You mean the Committee will grant a purchase clause.

The CHAIRMAN: No, we cannot grant a purchase clause.

Mr. *Keen* expressed the opinion that the Company did not require additional capital powers. He dealt with the capital expenditure charged to revenue, already admitted by the Company, and pointed out to what extent the consumers should have been benefited. He alleged that the Company had in every way attempted to defeat the interest of the consumer.

Mr. HONORATUS LLOYD cross-examined to the effect that, although capital sums had been charged to revenue, on the other hand the Company had not carried sums to special purposes fund which they were entitled to. To this extent the consumer had not been injured; the amounts practically balancing each other.

Mr. TALBOT then addressed the Committee for the Leyland Urban District Council. He commented on the extraordinary fact that during the whole history of the Company the capital expenditure had been about half the amount now asked to carry them over the next 15 years; and the reason was that there would be some abnormal development in that period. His claim was that the unexpended capital powers were ample. In any event, nothing more than the rate of expenditure in the past should be taken as the basis for the future. It was not at all clear as to whether the Company intended to extend the works or to completely reconstruct them. He submitted, however, that, having regard to the past history of the Company, things had not arrived at the stage when anything of this sort should be allowed. With regard to the new area, the conclusion must be drawn that there was no scope in it for gas supply. Discussing the policy of the Company in charging capital sums to revenue, he said that, whatever the effect in relation to what the Company might have done in other items, the policy was wrong. There was also a serious complaint that, whereas the price of gas had gone down, the extra charge for penny slot meters had gone up from 5d. to 9d.; and as 85 per cent. of the consumers were slot consumers, it was clear that the Company had done their very utmost to pay dividends without consideration for the consumer. The real position was that, by the large extra charge for fittings to the slot consumers, the Company had been able to reduce the price of gas and so pay high dividends; while in effect the consumers did not benefit. In addition, the Company had taken advantage of the ignorance of the consumers in order to push slot meters as against ordinary ones.

Mr. JEEVES opened the case for the West Lancashire Rural District Council. His point was that the Company merely believed that they could, for their own benefit, lay mains in the districts of Hesketh and Tarleton and supply gas; but no effort had been made to show that the districts wanted the supply. As a matter of fact, the inhabitants of the two districts did not want the Company to come there. The Company's present area and part of the proposed extensions were on

the other side of a river which separated them from the West Lancashire rural district; and there was nothing in common between the two. The inhabitants of the districts never wanted to go to Leyland; and if they had to go there for gas, it would be for that purpose and no other. Both Hesketh and Tarleton were likely to become urban districts; and all powers of such districts should be reserved to them.

Evidence was then called to this effect.

Mr. HONORATUS LLOYD, in cross-examination, said the Rural District Council could have a supply of gas in bulk from the Leyland Company to the extent of 3 million cubic feet per annum at 2s. 6d. per 1000 cubic feet if the Council preferred to have their own mains. Furthermore, the Company would be prepared to come under an obligation to lay the mains in Hesketh and Tarleton within two or three years—otherwise the powers should cease. Witness, however, would not depart from the point of view that a company so many miles away should not be granted powers such as were proposed. It was agreed, however, that the district should be lighted by somebody.

Mr. JEEVES pointed out that the Leyland Company could give a supply in bulk to the Rural District Council if the two districts were cut out, as their mains would then be up to the boundary.

In answer to questions by the CHAIRMAN, it was stated that the Parish Councils concerned would pay a higher price than was now suggested rather than be included in the Company's area.

The CHAIRMAN, during the course of a discussion as to the need for further evidence, said the Committee were satisfied that it would be cheaper for the Company to supply than anybody else. There were, however, difficulties which must be taken into consideration.

Mr. JEEVES said that he would prefer to call evidence that it would not necessarily be cheaper.

Mr. *W. M. Carr*, the Engineer to the Ormskirk Gas Company, said there were many suitable sites for gas-works in the districts of Hesketh and Tarleton, where production could be carried on very cheaply, and certainly not higher than the Leyland prices. On the other hand, a bulk supply might be taken in the first instance; and for this there were two authorities to quote. It would be to the general benefit of the districts to be allowed to work out their own salvation. As a matter of fact, the high-pressure mains of the Ormskirk Company were nearer than the mains of the Leyland Company; but he would not recommend his Directors to include the districts in the Ormskirk Company's area. It was exceedingly bad to have a district so far away from the centre of administration.

In cross-examination, witness said he would recommend separate works at a cost of £6000 to produce 6 million cubic feet of gas per annum. The capital charges and working expenses would be 2s. 10d. per 1000 cubic feet. The salary of the manager of such works would be 30s. per week. He anticipated a selling price of 4s., but would recommend a supply being taken in bulk if it could be obtained at 2s. or 2s. 3d.

This closed the case for the Rural District Council.

The room was then cleared. On the readmission of the parties,

The CHAIRMAN said it would not be necessary to hear Mr. Honoratus Lloyd on the whole Bill in reply, because the Committee were prepared to pass the preamble. They were not, however, satisfied that Hesketh and Tarleton should be included in the Company's area. They were quite prepared to give the other districts, subject to the Company laying their mains within five years. The Committee would like Mr. Honoratus Lloyd to address them as to the inclusion of Hesketh and Tarleton, and also with regard to capital powers, assuming that the districts were and were not added.

Mr. HONORATUS LLOYD said that if Mr. Jeeves had argued that this was a district which did not want gas, he could have admitted that there was a strong case; but this was not the argument put before the Committee. It seemed to be generally agreed that gas was wanted in the district; and he could see no reason why, in the absence of anybody else wishing to supply, the Leyland Company should not have the powers, as they would involve no injustice upon anybody. Mr. Carr had stated that the Ormskirk Company did not want want to go there; and Mr. Porter had stated that he had advised against the promotion of a separate company for the district. The Southport Corporation, which was also able to supply, did not seem over anxious to do so, because the only offer they had made to the Rural District Council was at a price which they would not look at. On the other hand, the Leyland Company had made an offer to supply a minimum of 3 million cubic feet per annum at 2s. 6d. per 1000 cubic feet. With regard to the capital powers, as he had stated in his opening speech, if he received the full Bill the additional capital required would be £57,169, which included £17,600 for electricity. If this were eliminated, the figure would be reduced to £39,568. On the assumption that no part of the extended area was required, this sum would be reduced to £30,416; while if Hesketh and Tarleton were excluded, the capital powers would be £33,449.

The CHAIRMAN said he was afraid Mr. Honoratus Lloyd had not been able to persuade the Committee to include Hesketh and Tarleton. The preamble of the Bill would be declared proved to include the districts of Little Hoole, Much Hoole, and Bretherton, provided mains were laid there within five years—otherwise the powers would cease. The capital powers would be modified accordingly.

The Bill was then ordered to be reported for third reading.

KIDSGROVE GAS BILL.

HOUSE OF COMMONS COMMITTEE.—Tuesday, March 17.

(*Before Sir* WILLIAM HOWELL DAVIES, *Mr.* ALAN SYKES, *Mr.* BLACK, *and Mr.* LYTTELTON.)

The objects of this Bill, promoted by the Kidsgrove Gas Company, are to alter and define the limits of supply of the Company, and to confer further capital powers, amounting to £25,000.

Mr. BALFOUR BROWNE, K.C., and Mr. BRUCE THOMAS appeared for the promoters. The Staffordshire County Council were represented by Mr. PARR, and the Cheshire County Council by Mr. LEWIS COWARD, K.C.

Mr. BALFOUR BROWNE, in opening the Bill, said it was to authorize the supply of gas in certain districts, including Kidsgrove—the Company's area running into both the counties of Staffordshire and Cheshire. Power was sought to raise further capital—the supply of gas having increased and the capital powers being exhausted; but there were two matters of rectification, which were not unimportant. There was a part of the parish of Audley which the Gas Company wished to exclude from their limits of supply, under the following circumstances. In 1878, an indenture was entered into between the Gas Company and the Audley Local Board, which purported to assign to the Local Board all the rights of the Company under their Act of 1871, which gave powers to manufacture and supply gas within the district. The Local Board acted on the assignment, and erected gas-works at Audley—of course, with the consent of the Gas Company; and it was not until 1906 that objection was raised by the Local Government Board that the assignment the Company had made was null and void. It clearly was, said Counsel, because no private company had power to assign the powers of an Act of Parliament without the consent of Parliament. At the same time, the Company desired to be loyal to the Board, and proposed in the Bill to exclude that parish from their area, because the Local Authority would have a right to supply, and were at the present time in a position to do so—having erected their works. The other matter was that the Company asked that the parish of Oldcott should be excluded from the limits of supply. This area was within the limits of supply of the British Gaslight Company; and in order that there might be no overlapping of areas, it had been agreed by the Kidsgrove Gas Company and the British Gaslight Company that a portion of Oldcott should be included in the limits of supply of the Kidsgrove Company and a portion within the new borough of Stoke-on-Trent in the area of the British Gaslight Company. Neither Company had mains in the area in question; and the point was absolutely unopposed. The only opposed question was one about the roads and bridges of the two County Councils mentioned. One of the local authorities—the Alsager Urban District Council, who were supplied by the Kidsgrove Company—had originally decided to oppose the Bill, but had withdrawn their petition. In dealing with the petitions, with regard to Staffordshire, there was no extension of the Company's area at all in that county—in fact, parts of the area in Staffordshire had been excluded. With regard to Cheshire, the Company had included the parish of Odd Rode; but there was really nothing substantial, in his opinion, in the petitions. Clause 22 of the Bill, which dealt with the laying of pipes for ancillary purposes, was objected to by both petitioners. The clause reads as follows:

> The Company may lay down and repair, take up, relay, or renew mains, pipes, and culverts within the limits of supply for the purpose of procuring, conducting, or disposing of any oil or other materials used by them in, or resulting from, the manufacture of gas or any residual products thereof, or for any purpose connected with their gas undertaking, and the provisions of the Gas-Works Clauses Act, 1847, with respect to the breaking-up of streets for the purpose of laying pipes and for the protection of pipes when laid, so far as they are applicable for the purposes of this section, shall extend and apply *mutatis mutandis* to and for the purposes thereof.

Ever since 1847 gas companies had been laying mains in public streets. But Parliament had been most careful to put a series of clauses in the Gas-Works Clauses Act, 1847, to protect the public rights, and to see that the roads were properly reinstated—which was the objection of the County Councils; and he would show that they were properly protected. The Company had powers under their Acts to repair roads; and in the district of Odd Rode they asked to be put under the same conditions as appertained to the rest of their area. The County Councils also asked for protection with regard to the breaking-up of bridges. Under the Gas-Works Clauses Act they were also fully protected on this point. There was no intention on the part of the Company to lay pipes all through the district, but simply to lay them between the two works of the Company, so as to convey the products from one works to the other. The petitions also asked that pipes should be laid at a certain depth in the main roads in the county areas, having regard to the fact that if the mains were damaged by heavy traffic, such as by steam-rollers belonging to the county authorities, the Company could claim damages. It would be to the Company's disadvantage if the mains were so near the surface as to be damaged by ordinary traffic; and he did not suppose that the County Council really objected to the way in which mains had been laid in the past. With regard to the Staffordshire County Council, he suggested that they thought the Company were going to lay mains right through the district, and had misunderstood the real position.

Mr. *James Beech*, the Engineer and Manager of the Kidsgrove Gas Company, corroborated Mr. Balfour Browne's statement that the Company had powers to break up streets.

Mr. BALFOUR BROWNE, in answer to a question by the Chairman, said that with regard to clause 22 the Company were under the general law. At the same time, he did not think they would have power to lay pipes to carry oil without the consent of Parliament to a clause on the subject.

Mr. LEWIS COWARD, on behalf of the Cheshire County Council, in cross-examination, said that there were 11 miles of main road of the county of Cheshire now in the Company's area of supply, and eight county bridges, and asked if some of the mains already existing in these roads would sooner or later have to be relaid.

Witness said that some of them would.

Mr. COWARD said that the Company had first objected to the Cheshire County Council being granted *locus* to appear against the Bill in Committee; but the Court decided that they were entitled to be heard for further protection in respect of the new area of Odd Rode, and also in respect of the Cheshire County Council area where the Company's pipes had already been laid. He suggested to witness that it would not be unreasonable under the circumstances that, both with regard to the position and the depth at which the Company laid their mains, the conditions should be such as the County Surveyor might reasonably direct. He also maintained that the Council should be allowed these powers, having regard to the fact that they employed

between 500 and 600 men for making roads, and had about twelve steam-rollers, while the Gas Company had only 20 men, and no steam-rollers.

Mr. BALFOUR BROWNE said that, in this case, terms should be submitted to the Company by the Council, upon which the latter would do the reinstating.

Mr. COWARD, dealing with the question of the Company giving seven days' notice, instead of three, to the County Council with regard to breaking-up streets, said that three days did not give the Council much time to call together a Committee. Witness, however, thought this was plenty of time. Counsel remarked that under the general law the Council had no power to make the Company carry their mains outside a bridge where there was not sufficient room in the roadway of the bridge. Witness agreed, and admitted that it was reasonable in some cases to go outside. Counsel also pointed out that if the Company did not go outside the bridge, and insisted on laying the mains under the roadway across the bridge, even though it would be unsafe to do so, the County Council would be compelled not to take any heavy traffic over the bridge at all if the Gas Company did not cut into the structure of the bridge. Witness had no objection, however, to the County Council moving the Company's pipes when altering the roads, provided they paid the cost. The average length of road broken-up by the Gas Company in order to lay mains was 60 yards at one time; and he would have no objection to coming under a limit that the Company should not break-up more than this distance, or 100 yards, at one time. He did not think the wear and tear upon one side of a road during the short time the other side was broken-up was appreciable. Therefore he did not think the Company should be liable for any damage done to one side of the road owing to concentration of the traffic. Counsel suggested that instead of going to the Justices when the Company sued the County Council they should go before an arbitrator, who would be an engineer agreed between the parties, or, failing this, to be appointed by the President of the Institution of Civil Engineers. Witness, however, objected to this, on the ground that the cost would be too great, and he much preferred the Justices.

Mr. PARR, on behalf of the Staffordshire County Council, did not cross-examine at any length, inasmuch as he would necessarily cover practically the same ground as that covered by Mr. Coward on behalf of the Cheshire County Council. He suggested, however, that under the general law the question was left open as to what constituted delay where streets were broken-up, and it might be convenient in the case of delay to have a reasonable limit of time prescribed, so that what constituted delay might be defined, and thus get rid of any friction between the County Councils and the Company.

Mr. BALFOUR BROWNE, in re-examination, pointed out that, with regard to the Cheshire County Council's staff of between 500 and 600 men for the maintenance of roads, as compared with the Company's staff of 20, it was not the work of the Company to maintain the roads. With regard to the period of three days as the notice to be given to the Council for breaking-up streets, there were about 1000 gas companies in this country who only gave three days' notice.

Mr. COWARD objected to this statement, and said that clauses had been agreed between gas companies and local authorities over and over again for a longer period to be given.

Mr. BALFOUR BROWNE maintained, in regard to carrying mains over bridges, that the Company had no power to touch the structure of the county bridges.

This closed the case for the Bill.

Mr. *William Holland*, the County Surveyor to the Cheshire County Council, said that the Council were always in trouble with regard to gas-mains, and they felt that their powers were not strong enough under the general law to deal with the matter.

Mr. COWARD then handed in clauses dealing with the protection of the Cheshire County Council. The first of these dealt with the length and depth of the pipes to be laid in the county roads, and stated that this should be determined reasonably by the Council. Witness said that, in his opinion, it was absolutely necessary that the County Council should be in a position to fix the depth of the mains, as in the past they had been laid at insufficient depth, and there was frequently friction between the Council and gas companies with regard to damage done through the Council's steam rollers passing over them.

The CHAIRMAN asked whether a general depth was usually adopted by all gas undertakings.

Mr. COWARD said that it was left to the gas companies. The difficulty was now becoming intensified by the manner in which the roads had to be constructed to stand the more strenuous conditions being put upon them. The Kidsgrove Gas Company had never complained to the Council with regard to damage done to their mains.

Mr. LYTTELTON asked if this provision was simply for the future.

Mr. COWARD said that the provision was for new pipes, and also for any mains relaid.

With regard to the next clause, which asked that seven days' notice should be given to the Council for breaking-up streets, instead of three, as at present, witness held that seven days at least was necessary.

The CHAIRMAN asked whether this notice applied to a case where the road had to be taken up for repairs.

Witness replied that it only applied to new works.

Mr. BALFOUR BROWNE said he did not think it referred to emergency cases at all.

The next clause specified that the Company should not interfere with the structural part of any bridge or approach without the consent in writing of the Surveyor of the County Council, which consent was to be given under such conditions as the County Council might reasonably determine.

Witness agreed that this was a very serious danger.

Clauses 5 and 6 dealt with protection for the Cheshire County Council with regard to the right to alter and improve roads along which mains, pipes, &c., were laid, if they think fit.

Clause 7 provided that the length of road to be taken up at any one time in order to lay mains should not exceed 100 yards.

Mr. LYTTELTON asked if the Council had had any experience of more than 100 yards being taken up at one time.

Witness said they had, and great trouble had been experienced in dealing with the traffic. The reason, of course, was that it is much more economical to open up longer pieces of road.

Clause 8 provided for costs to be paid to the County Council for damage done to their roads by reason of the laying of pipes. Witness explained that this damage is done through the traffic being forced on one side of the road, and running along in a narrow groove.

Clauses 9 and 10 dealt with compensation to the County Council for not filling up the trenches properly after laying mains. Witness said it was very necessary that the County Council should be in a position to take over the trenches, as an allowance was left by the gas company for subsidence. The consequence was that traffic avoided the trench, and so wore the surface of the road unevenly. The Council therefore wanted power to take over the trenches after they have been filled in, and do the work themselves, owing to the fact that they were properly equipped for dealing with the matter.

Clause 11 provided that the County Council should not be liable for damage done to pipes by reason of their being laid at a depth insufficient for their protection from injury. Of course, if the first clause be allowed, No. 11 would not be required. The position at the present moment was that for the existing mains there was no protection; and the clause provided for this.

Mr. LYTTELTON said that if the County Council were granted this clause they would have powers against the Gas Company which they could not have against any other company in Cheshire on the existing mains.

Mr. COWARD agreed with this.

Clause 22, which dealt with power to lay pipes for ancillary purposes, was to the effect that the Company should not break-up streets in connection with these pipes without the consent of the County Council.

The CHAIRMAN suggested that if these powers were not taken by the Company the oil and residual products, &c., would have to be taken by road.

Witness said he did not think there would be much disadvantage arising from the cause.

The last of the suggested clauses proposed was to the effect that, if any difference arose at any time between the County Council and the Company touching this section, it should be settled by arbitration—the arbitrator being an engineer to be agreed between the parties, or, failing agreement, to be appointed by the President of the Institution of Civil Engineers; and the Arbitration Act of 1889 should apply.

Mr. BALFOUR BROWNE, in cross-examination, pointed out that the general law was proposed to be altered by the County Council. He referred to the case of the Woking Bill in 1912, when these clauses were proposed, but were all rejected.

In answer to a question by Mr. LYTTELTON, Counsel said that the cost of alterations to the county roads at present was borne by the County Council. On the question of altering a road, the Council were at present compelled to leave the Company's pipes where they were. But he thought it was reasonable of them to move the pipes of the Company if they desired, provided they paid the cost. He did not agree that an arbitrator would be better than the Justices to decide differences between the two parties, though witness said it would be a much readier method, and the arbitrator would be a practical man.

Mr. COWARD, in addressing the Committee, said that the points raised in the clause submitted were urged because the change of circumstances which had arisen in the past few years over these roads had been such, both with regard to the traffic upon the roads and the nature of the roads themselves, as to make it necessary to strengthen the hands of the authorities, so that the whole of the roads might be consolidated, as it were. It was solely for this purpose that the Council's petition had been presented. Mr. Balfour Browne had said that the Council wanted the Committee to alter the general law. He maintained that this was the real reason the Committee rooms existed—to bring the general law into general harmony with the conditions in different districts.

Mr. BALFOUR BROWNE, coming back to the question of the pipes for ancillary purposes, said that although the Company had power to lay gas-mains, he did not know that they had powers to lay ancillary pipes. He was quite prepared to limit the power to show that it was only intended to lay this pipe between the two works, and also that the Company would not lay an inch of these ancillary pipes in the County of Cheshire at all, because the two works of the Company were in the Staffordshire district.

Wednesday, March 18.

Mr. *Moncur*, the County Surveyor to the Staffordshire County Council, gave evidence of the same character as Mr. Holland. One point made by the witness, however, was to the effect that the road in which gas-pipes were laid might subside, and so affect the pipes, though it would make no difference to the surface. The roads would therefore have to be broken-up in order to repair the pipes, and the County would have to suffer damage through concentration of the traffic on one side of the road.

Mr. PARR, on behalf of the Staffordshire County Council, addressed the Committee to the same effect as Mr. Lewis Coward.

Mr. BALFOUR BROWNE, in reply, said that, with regard to the extra traffic on the roads owing to the altered conditions, the Company were not responsible for this. Yet the County Councils wanted them to bear the burden of the extra traffic when the roads were being repaired after the laying of gas-mains. In regard to the clauses proposed on behalf of the Cheshire County Council, he disagreed with many of them while, on the other hand, agreeing to slight alterations in others. No objection, however, was taken to the County Council having seven days' notice, instead of three.

The Committee having deliberated in private,

The CHAIRMAN announced their decision. This gives the Cheshire County Council the right to prescribe the position of the pipes and mains in the main roads, subject to the decision of two Justices sitting in a Court of Summary Jurisdiction in case of difference; but the County Council are not to prescribe the depth at which they are to be laid. In the case of a county main road or bridge being altered by the County Council, the Gas Company are to remove their pipes, and the

County Council are to repay the Company the cost of such removal. But the Committee refused to grant the Company any compensation for damage that might be done. The Committee also passed a clause that the Company should not break-up more than 100 yards of road at the same time, and that reasonable precautions should be taken not to interfere with traffic. The proposed clause extending the notice to be given to the County Council from three to seven days was passed.

This decision only applies to the Cheshire County Council, in whose area a new district is being taken by the Company. The Committee refused to give similar powers to the Staffordshire County Council, as no new districts were taken in that area.

The following are the clauses which the Cheshire County Council secured. We also give the terms of the ancillary clause.

Clause for the Protection of the Cheshire County Council.

Clause 13.—The following provisions for the protection of the County Council of the administrative county of Cheshire (in this section referred to as the County Council) shall, notwithstanding anything in the Act contained and unless otherwise agreed between the Company and the County Council, apply and have effect with respect to the exercise of any powers of the Company in or affecting any main road or any county or main road—bridge, or approaches thereto, in the limits of supply vested in the County Council, that is to say:—

(1) All future pipes and works to be laid in or along any such road, or in, or upon, or across any such bridge or approach thereto, shall be laid in such position in or at the side thereof as the County Council, in writing, under the hand of their surveyor, may reasonably direct.

(2) The notice required by section 8 of the Gas-Works Clauses Act, 1847, with respect to the breaking-up of streets shall, as regards any such road, bridge, or approach, be not less than seven days instead of three.

(3) Nothing in this Act contained shall interfere with the right of the County Council to alter the level, or deviate, or improve, in any manner that they think fit, any main road in or along which any mains, pipes, or works of the Company shall have been laid, to remove, alter, rebuild, widen, or repair any county or main road, bridge, or approaches thereto, or the roadway over the same, over, or near, or attached to which any mains, pipes, or works of the Company are carried, and the Company shall forthwith, on receiving notice in writing under the hand of the clerk or surveyor to the County Council so to do, alter the position of any such mains, pipes, wires, or works in the manner and to the extent prescribed by such notice, or as, in case of difference, shall be determined in the manner hereinafter prescribed, and the County Council shall repay to the Company the expense reasonably incurred by the Company in effecting any such alteration of the position of any such mains, pipes, wires, or works.

Provided that during the removal, alteration, rebuilding, widening, or reparation of such bridge, or the roadway over the same, or the approaches thereto as aforesaid, the County Council shall afford all reasonable facilities for temporarily carrying such mains and pipes across any stream or river so as not to interrupt the continuous supply of gas, or diminish the pressure of such supply through such mains or pipes.

(4) The works shall be so executed by the Company as not to stop, or (so far as reasonably practicable) impede, or interfere with, the traffic of any such road or over any such bridge or approach, and the Company shall not break up at any time a greater consecutive length than 100 yards of any such road, bridge, or approach.

(5) If any difference arises at any time between the County Council and the Company touching this section, or anything to be done or not to be done thereunder, such difference shall be referred to two justices sitting as a court of summary jurisdiction, who shall determine the matter in dispute in all respects as if the same were a difference between the Company and the County Council under the Gas-Works Clauses Act, 1847.

Clause with regard to Laying Ancillary Pipes, &c.

Clause 25.—The Company may lay down and repair, take up, re-lay, or renew, mains, pipes, and culverts within so much of the urban district of Kidsgrove as is within one half mile of the gas-works of the Company for the purpose of procuring, conveying, or disposing of, any oil or other materials used by them in, or resulting from, the manufacture of gas, or any residual products thereof, or for any purpose connected with their undertaking, and the provisions of the Gas-Works Clauses Act, 1847, with respect to the breaking up of streets for the purpose of laying pipes, and for the protection of pipes when laid so far as they are applicable for the purpose of this section, shall extend and apply *mutatis mutandis* to and for the purpose thereof.

SOUTH BANK AND NORMANBY GASLIGHT BILL.

HOUSE OF LORDS COMMITTEE.—Thursday, March 19.

Before Lord HAVERSHAM, *Chairman*, *Lord* ABINGER, *Lord* OROMORE, *Lord* TEMPLEMORE, and *Lord* LOVELACE.)

The object of this Bill is to extend the limits of supply of the South Bank and Normanby Gaslight and Coke Company, and to repeal the powers of the Middlesbrough Corporation to supply gas within the existing and extended limits of supply of the Company.

Mr. HONORATUS LLOYD, K.C., and Mr. CLODE, K.C., appeared for the promoters. Mr. BALFOUR BROWNE, K.C., and Mr. W. J. JEEVES represented the Middlesbrough Corporation, the only opponents.

Mr. HONORATUS LLOYD, in opening the case for the promoters, said that the main objects of the Bill were to extend the limits of supply of the Company, to include a part of the parish of Marton in its area, and to repeal the powers of the Middlesbrough Corporation to supply gas in that district. The Company was incorporated in 1866 by local gentlemen for the purpose of developing the district, and for supplying gas to South Bank and Normanby and the neighbourhood. The capital powers were originally £5000; and the population supplied amounted to about 8000. The development of the undertaking having been very great, the Company in 1871 applied for, and obtained, a Provisional Order to enable them to supply gas under statutory authority; and it authorized them to supply within certain limits, including the townships of Normanby and Eston. The capital was also increased to £10,000. The maximum price to be charged for gas was fixed at 3s. 5d. per 1000 cubic feet, and the maximum dividend at 7 per cent. Again the development of the district had been rapid; and in 1877 another Provisional Order was obtained, in which their limits of supply were extended, and the capital was further increased to £50,000. The Company at that time came under the sliding-scale system, which provided that the dividend should be 10 per cent. for the £10,000 authorized under the 1871 Order, and 7 per cent. on the extra £40,000 authorized under the 1877 Order. The standard price was fixed at 5s.; and borrowing powers to the extent of £12,500 were authorized. The amount of capital unissued under the Order of 1877 was £4560 share capital, and £12,500 loan capital; making £17,060 unissued altogether. In addition to the townships of Normanby and Eston, which were now two substantial urban districts, with a population little short of 30,000, the parish of Wilton was also included. This was entirely an agricultural district, and there had been no demand for a supply. The parish of Ormesby was also partly in the area of supply of the Company, having a population of some 398. With regard to the parish of Marton, which had a population of about 700, a portion of which the Company were authorized to supply, this had been included in the area of the Middlesbrough Corporation, which was recently extended; and the Corporation were also authorized to supply gas in a portion of the parish of Marton. The consequence was that the supply areas of the Corporation and the Company overlapped in this district. In view of this fact, the Company asked that the Corporation's powers to sell gas in respect of the area supplied by the Company be repealed, having regard to the fact that the Company had given a supply in Marton, while the Corporation had done nothing in regard to this district until a few months ago. The gas-works of the Company were very good, and were substantially in excess of the present requirements. The Company had done their duty to the public, and had given satisfaction to all. They had been able to reduce the price of gas from time to time from a net price of 3s. 8d. to 2s. 11d. per 1000 cubic feet—the latter being the figure at which the gas was now supplied. The gas supplied through slot meters was charged at the rate of 3s. 5d.

Mr. BALFOUR BROWNE remarked that the reduction to 2s. 11d. did not come into force until April 1 of this year.

Mr. HONORATUS LLOYD apologized for having been a little too previous. Continuing, he said that the public lighting was carried out in Normanby and Eston, and also in Ormesby, by the Company, by arrangement with the local authorities. The full dividends had never been so far paid by the Company, although the sliding-scale had enabled this to be done. With regard to the Middlesbrough Corporation, they obtained powers to supply gas in 1886—the same year as the Company was incorporated—and they were authorized to light the streets and places within their area, and within Marton, Ormesby, and Normanby. The Corporation were also given power to supply gas upon terms to be agreed between the Local Board and the person to be supplied; but they were not to lay mains in Ormesby without the consent of the Ormesby Local Board. Ever since 1866 the Corporation had been empowered to supply the districts to which he had referred; but in respect of the great bulk of the area they had done nothing at all. Nothing was done by the Corporation between 1866 and 1871, when the Company obtained their Provisional Order; and the Corporation did not raise a finger against it. In 1877, also, when Ormesby was included in the Company's area, the Corporation had not opposed. This showed that they did not regard these districts as important to them; and now, 48 years later, they were giving no supply in Ormesby nor in Normanby, and were making no attempt to do so. The Company, however, were giving a supply in this area, and giving it to the satisfaction of everybody. The Corporation should no longer have powers which had lain in abeyance for 48 years—especially as it was not the practice of Parliament to grant overlapping powers. It was very inconvenient that there should be two authorities supplying gas in one area, because this would involve laying separate mains in the same roads. Counsel also referred to similar cases in which overlapping powers had been repealed. In 1913, the Middlesbrough Corporation had sought to include Eston and Normanby, and part of Ormesby and Marton, in the borough of Middlesbrough. The application for this extension was made by Provisional Order. Eston and Normanby, however, were violently opposed to this, and fought the question in Parliament, with the result that in the First House the Local Government Board Order, so far as it referred to the districts, was thrown out, and Eston and Normanby still remained urban districts.

At this point, Mr. HONORATUS LLOYD said that he was informed that the Corporation and the Company had come to an agreement, and therefore the opposition would be withdrawn.

Mr. BALFOUR BROWNE said that a boundary had been settled between the parties. It had been decided that it would be quite wrong to take away the right of supply where the Company were actually supplying. The district the Company were to have was where they were supplying gas at the present time; the overlapping powers of the Middlesbrough Corporation, therefore, being repealed. The portion of Marton already included in the Corporation's area of supply, however, was still left to the Corporation.

The CHAIRMAN asked if Eston and Normanby remained with the Company.

Mr. BALFOUR BROWNE said this was so. The Corporation had nothing to do with Eston; and though they had powers to supply in Normanby, they were willing that these should be repealed.

The clause dealing with this matter will be brought up for consideration by the Committee as soon as drafted.

BEDWAS AND MACHEN URBAN DISTRICT COUNCIL BILL.

HOUSE OF COMMONS UNOPPOSED BILLS COMMITTEE.
Tuesday, March 17.

This Committee, over which Mr. WHITLEY, the Chairman of Ways and Means, presided, had before them to-day the above Gas Bill. Gas supply powers are sought in it by the Urban District Council of Bedwas and Machen.

Mr. LEES (Messrs. Lees and Co., Parliamentary Agents) explained that the Bill authorized the Urban District Council of Bedwas and Machen to supply gas in the parish of Machen Upper and in parts of certain adjoining parishes. The Board of Trade in a report had pointed out that it was unusual to give gas powers such as were sought in the Bill to a small urban district council where the population was not large. In this case, however, it could be clearly shown that the construction of gas-works would result in gas being supplied in the district by the Council on terms much more favourable to the consumers than could be obtained from any other source. As a matter of fact, the Council had succeeded in making an agreement for a bulk supply with the Rhymney and Aber Valleys Gas Company (who had works in the adjoining districts) to Bedwas and Machen; the terms of the agreement being for seven years at a price of 2s. 4d. per 1000 feet for a minimum quantity up to 3 million cubic feet, and 2s. 3d. when the quantity exceeded 3 millions. This arrangement, it was calculated, would enable the Council to build-up a business during the next seven years, and then possibly construct their own works, the land for which was scheduled in the Bill. There was no doubt that the district was developing very rapidly. The maximum price asked in the Bill was 5s.; but it was expected that supply would be given at 4s. 6d. This price compared very favourably with that charged in the neighbouring districts. On the question of the testing, the Council had adopted the Porthcawl calorific value test, which was as follows:

> Clause 15.—The gas supplied by the Council within the limits of supply shall, when tested in the mode and under the conditions for the time being prescribed by the Metropolitan Gas Referees for testing the calorific value of gas, be of a standard calorific value of 540 B.Th.U. gross per cubic foot (the expression "British thermal units" being used in this part of this Act as meaning British thermal units gross per cubic foot): Provided that the Council shall not be liable to any penalty or proceedings for, or in respect of, deficient calorific value of the gas so supplied by them except in accordance with the provisions hereinafter contained.

The Secretary of the Company gave evidence in support of the preamble; and the Committee ordered the Bill to be reported for third reading.

The capital powers included in the Bill are £10,470 for the erection of gas-works, and £1000 for working capital.

RIDDINGS GAS BILL.

This Bill—promoted by the Riddings Gas Company for, among other purposes, extending the limits of supply and acquiring the undertaking of the Pinxton Gaslight and Coke Company—came before the same Committee as the Bedwas Bill (*supra*).

Mr. SIDGWICK (Messrs. Rees and Frere, Parliamentary Agents) explained that the objects of the Bill were to extend the limits of supply of the Riddings District Gas Company and to authorize the acquisition of the undertaking of the Pinxton Gaslight and Coke Company—a neighbouring non-statutory undertaking which was now supplying gas on the north-east boundary of the Riddings Company's area. Terms had been arranged for the purchase on the basis of the Pinxton shareholders being given 10 per cent. stock in the Riddings Company of the same nominal value as the shares held by them in the Pinxton Company. The total amount of stock so exchanged had a nominal value of £7500. When the transfer was complete, the Riddings Company's area would be extended to include that of the Pinxton Company. The total share capital issued by the Riddings Company was £39,000, and, in addition, there was £11,000 unissued. The Bill asked for £10,000 extra share capital, with the usual one-third borrowing powers. This, it was anticipated, would carry the Company on for 14 years. The Bill also proposed to substitute a calorific value test for an illuminating power test; and the clause suggested was almost exactly the same as that in the South Suburban Gas Bill. There were, however, two exceptions. The first was that a definition was given of British thermal units, which also appears in the Liverpool Gas Bill pending this session. The clause is as follows:

> Clause 35.—Within six months from the passing of this Act the Company shall provide at the testing-place provided under the Act of 1888 (hereinafter referred to as the "prescribed testing-place") apparatus for testing the calorific value of the gas supplied by them, and such apparatus shall consist of a calorimeter to be agreed upon between the Company and the Urban District Council of Alfreton, or, failing agreement, to be approved by the Board of Trade, which shall be capable of being and shall be so used as to yield the total heat value of the gas expressed British thermal units.

The object of the definition was to make clear what the temperature of the gas was to be, and what the atmospheric pressure was to be, at the time a test was taken. The Liverpool Company's Bill would come before a Committee of the House of Lords. The promoters of the Riddings Bill were quite prepared to adopt any decision come to in respect of the Liverpool Bill if embodied in the Model Clauses for a future calorific test. Any amendments to this effect would have to be introduced at a later stage. With regard to the apparatus that was proposed to be used for the purpose, it was specified in the clause that it should consist of a calorimeter to be agreed upon, or, failing agreement, determined by the Board of Trade. Such an instrument was the Simmance-Abady calorimeter, which was mentioned in the Liverpool Bill; but this portion of the Liverpool clause had not been followed in the Riddings Bill. No calorimeter was specified; but here, again, the decision in the Liverpool Gas Bill would be followed. Another Bill upon which an important decision would be come to in regard to the question of calorific testing was that of the Gas Light and Coke Company, which proposed to substitute the calorific test for the illuminating test. In that case, as in the Liverpool case, the Gas Light and Coke Company were asking that the testing apparatus should be the most suitable for ascertaining the total heat value of the gas.

In reply to the CHAIRMAN, Mr. Sidgwick said that there were 17 Bills this year in which a calorific test was proposed. The majority of them followed former precedents, and stated that the calorific apparatus should be that prescribed by the Metropolitan Gas Referees, with certain variations.

The CHAIRMAN: I understand you to say you are prepared to defer the final stage of your Bill, at any rate in the other House, and to put in the new form of clause that is decided after these other Bills have been dealt with.

Mr. SIDGWICK said he did not think he could go so far as that. The Liverpool and the Gas Light and Coke Companies were exceptional Companies; and terms might be put upon them which should not be made applicable to an ordinary small gas company. He understood, however, that there was likely to be some addition to the Model Bill in respect of the calorific value test.

Mr. MOON, K.C. (the Speaker's Counsel) remarked that this would depend upon what Parliament did. The Model Bill could not take the initiative.

Mr. SIDGWICK said that if the new Model Clauses were drafted he was prepared to have them in this Bill.

The CHAIRMAN remarked that the authorities of the House would do their best to get a uniform clause settled this year.

Mr. *Benjamin Ely*, the Manager of the Ridding Gas Company, gave evidence in support of the preamble; and the Bill was ordered to be reported for third reading, subject to the reservation of the calorific value clause.

ELLESMERE PORT AND WHITBY URBAN DISTRICT COUNCIL BILL.

HOUSE OF LORDS COMMITTEE.—Monday March 16.

(*Before Lord* BALFOUR OF BURLEIGH, *Chairman*, *Viscount* FALMOUTH, *Viscount* RIDLEY, *Lord* MONTEAGLE, *and Earl* ROSSE.)

This Bill is to authorize the Ellesmere Port and Whitby Urban District Council to purchase the gas-works of the Shropshire Union Railways and Canal Company, and to confer further powers upon the Council with regard to the supply of gas and electricity.

Mr. WEDDERBURN, K.C., and Mr. BAILEY appeared for the promoters; and Mr. G. M. FREEMAN, K.C., with Mr. J. W. JEEVES, represented the Sutton and Hooton Gas Company, Limited, the only opponents.

Mr. WEDDERBURN, in opening the case for the promoters, said the only supply of gas in the district at present was from the Shropshire Union Railways and Canal Company. The Company started making gas for their own purposes many years ago, but later on supplied other people as a matter of convenience, and in 1893 tried to get statutory authority to supply. They failed, but obtained a special clause to the effect that they might from time supply at and near Ellesmere Port gas not required for their own purposes. The Ellesmere Port Authority, however, were now desirous of becoming the suppliers of gas for the whole of their district, and had agreed to buy out the Shropshire Company at an arbitration price, under an agreement, which would be scheduled to the filled-in Bill. When the Council had bought the Shropshire Company's works, they intended to remove them to another site, for the reason that the existing site was needed by the Shropshire Company, and, further, that the new site was more convenient. It was also desired to take in the parishes of Chorlton, Croughton, Little Stanney, and Stoke. The parish of Backford was included in the Bill originally; but objection was taken, and it was struck out, because it was not of much value to the Council. It was with regard to the inclusion of the parish of Overpool that the only opposition arose. The Sutton and Hooton Gas Company had had the right to supply Overpool since 1909—just before the time when Overpool was included in the Urban District of Ellesmere Port and Whitby, which took place in 1910. Although the Sutton Gas Company had had the right to supply in Overpool since 1909, they had never done so; and the promoters wished, having regard to the convenience of the public, to supply in that parish. All that it was proposed to do was to take from the Sutton Gas Company an unexercised right, which they would not have got had the extension of the urban district of Ellesmere Port preceded the extension of the Company's supply area. It was a small concern, making about 20 million cubic feet of gas per annum. The Council could supply at a lower price, because the Railway Company supplied at a lower price than the Sutton Company. The present prices of the Shropshire Company were 3s. 9d. and 3s. 6d., with 5 per cent. discount, as compared with the Sutton Company's price of 3s. 11d. The latter Company had no mains in Overpool. Therefore there was nothing to compensate them for; and even in the petition it was not suggested that they should be compensated. They simply suggested that they should be allowed to continue with their rights in Overpool, to the exclusion of everybody else. But they did not intend to supply Overpool until they thought it would be a profitable undertaking. It would be easy to extend the Council's mains, as they came very close to Overpool. But the Sutton Company would have to carry a long main from their works, and also get power from the promoters to break up roads, and so on.

Mr. *William Stockton* (a member of the Urban District Council of Ellesmere Port and Whitby), Mr. *Joseph Burrows* (also a member of

the Council), and Mr. *Hudson* (Surveyor to the District Council) gave evidence in support of the Bill.

Mr. *William Newbigging* said he had advised the Ellesmere and Whitby Council with regard to the gas-works of the Shropshire Union Railways and Canal Company, and also as to the proposed new site, which was much more desirable and convenient than the old one. The present make of the Shropshire Company was about 27,000 million cubic feet per annum; but this would be increased to 50 millions when the Council's new works were erected. It would be much simpler to supply Overpool from the mains of the Shropshire Company than to carry the gas from the Sutton Company's works, owing to the fact that, although the Sutton Company's works were much nearer the Overpool boundary than the Shropshire works, the pipes of the latter Company go right up to the boundary, and would only have to be extended to the houses to be supplied from the mains already existing. With regard to the calorific value, which was said to be much lower in the case of the Shropshire Company's gas than that supplied by the Sutton Company, the Lord Chairman had made an alteration in the Bill on this point. The people living in Overpool, where there were only twelve or fourteen houses, it was true, would have to contribute to the rates if the gas undertaking of the district failed. But they would not, on the other hand, have the option of getting a supply of gas if the Council did not supply, or, if they did, not at such a cheap price as the rest of the urban district. Speaking on the question of precedent, witness mentioned the case of the Leigh Local Authority, in which a gas company's powers to supply in a certain area were not exercised, and Parliament repealed them. This also occurred in the case of the Long Eaton Gas Company.

Mr. FREEMAN, in cross-examination, argued that the two cases quoted were not the same as the present case in detail. Witness agreed that they differed in many minor respects. Counsel remarked that the only three parallel cases which he had been able to find were the Barton-on-Sea, Bexhill, and South Hants Water Bills. In these cases, Parliament did not repeal the powers to supply, although they were unexercised. Under the Public Health Act, so long as there was a company able and willing to supply gas, the local authority could not supply. Therefore the Ellesmere Port Authority were asking Parliament to give them special powers to supply in the present instance. Witness submitted that the people of Overpool were suffering hardships, inasmuch as they were not at present able to get a supply of gas. Counsel remarked that he thought witness had gone a little too far in saying this, having regard to the fact that none of the inhabitants of Overpool had ever asked for a supply.

This closed the case for the Bill.

Mr. *W. M. Carr*, the Engineer and General Manager of the Ormskirk Gaslight Company, said that the Sutton and Hooton Gas Company's works had been built by his father. He did not know of a similar case to this where the powers asked for had been granted. No application had ever been made for a supply for the district; but the Sutton Company had laid many mains, and were in a better position to supply in Overpool than the Ellesmere Port Council. The mains were of sufficient size to allow of any increase in the demand. The length was 17 miles; while the consumption was only about a million cubic feet per mile. Notwithstanding this capital expenditure in advance, the Company were supplying at a cheaper rate than the Shropshire Company. The Sutton Company also supplied a better quality gas. The Bill would take away from the Sutton Company a very valuable area.

Mr. WEDDERBURN asked why compensation was not asked for in the petition of the Sutton Gas Company.

Mr. JEEVES, for the Sutton Company, said it was not compensation that was wanted. The Company desired to be left alone.

The CHAIRMAN said there had been no evidence that the area was of any value to either party.

Mr. FREEMAN said the real pecuniary loss if the area was taken away at once would be *nil*. But the works and mains had been laid out with a view to dealing with the area when the anticipated development took place.

Witness said more land had been purchased and a larger trunk main had been laid than would have been necessary if Overpool had not been there. This main was about 200 yards long.

Mr. FREEMAN, addressing the Committee, said he was not surprised that the Chairman had said the matter was a small one; but the principle involved was an important one, and had frequently to be dealt with in the Committee rooms. The Sutton Company had not developed the particular area in question; but they were entitled to keep it unless it was shown that they were not doing their duty in this area. It was only five years ago that Parliament gave them the district; and the mere fact that the Ellesmere Port Council had extended their district was no jnstification for taking away a portion of the Company's area. There was no evidence that there had ever even been an application to the Company for a supply of gas; and he submitted that this was not a case where in parliamentary history this precedent should be set up. There was no case in which this had been done except where neglect of duty had been proved. The Company did not ask for guarantees from its consumers, but supplied gas to every one on request. Extra land had been purchased and works erected on the faith and the action of Parliament in granting the Company an area where considerable development was looked for.

Mr. WEDDERBURN, for the promoters, said if anything was to be done in this matter it must be done now. In asking to be constituted the gas authority throughout the whole of the area, the Council thought they should be the only gas authority, and more particularly as the Company had done nothing in Overpool. Two gas authorities created confusion. He only wished the Company had done something, because then compensation could have been paid. As things stood there was nothing to compensate for. There would be considerable difficulties if the Council did not have powers to supply in Overpool. It was desirable that all the people should be supplied with the same gas at the same price; and the Council would have the calorific power clause which was at present under consideration. The whole matter should rest on the dominating factor of public convenience. The Company did not have the calorific power test, while its price would be different from that of the Council. On these grounds he asked the Committee to give the Council the Overpool area.

After the Committee had deliberated in private,

The CHAIRMAN said: The Committee are of the opinion that the Bill must be amended so as to cut Overpool out of the proposed area of supply.

Mr. FREEMAN then made an application for costs under the Standing Order which gives a Committee power to allow costs against parties when the opposition had been brought before the Committee unreasonably and vexatiously.

Mr. WEDDERBURN resisted the application, on the ground that it was a perfectly reasonable thing for the Council to wish to become the gas authority for the whole of the area in the circumstances.

Mr. FREEMAN said the Council had already struck Backford out of the Bill on the opposition of the gas authority there; and he could see no reason why the Sutton Company had not been served in a similar manner, and all the expense of coming to Parliament saved.

Mr. WEDDERBURN said Backford was not within the Council's area. This was the reason it was struck out of the Bill.

The CHAIRMAN said the Committee were unanimously of the opinion that this was not a case in which costs should be allowed.

The Bill was ordered to be reported for third reading.

The Bill, as deposited, included a calorific value test clause. But this matter stands over pending the settlement of a clause which will go into the Model Bill and which will be decided in connection with the Gas Light and Coke Company's Bill. Powers are also taken for obtaining a supply of electricity in bulk from any authority or person able to give it. The financial provisions of the Bill include borrowing the amount of the purchase of the existing gas-works; £16,350 for new gas-works; £1500 for mains; £6500 for services, meters, stoves, and fittings; and £500 for working capital.

WHITWELL AND DISTRICT GAS BILL.

HOUSE OF LORDS COMMITTEE.—Thursday, March 19.

(*Before Lord* HAVERSHAM, *Chairman*, *Lord* ABINGER, *Lord* OROMORE, *Lord* TEMPLEMORE, *and Lord* LOVELACE).

The object of this Bill is to reincorporate the Whitwell and District Gas Company, Limited, and to confer further powers upon them.

No Counsel appeared for the promoters, as explained below. The Hon. J. D. FITZGERALD, K.C., and the Hon. EVAN CHARTERIS appeared for the Institute of Chartered Accountants and the Society of Incorporated Accountants and Auditors, and Mr. G. M. FREEMAN, K.C., for the London Association of Accountants.

Mr. FITZGERALD said that in the Bill as originally deposited there were two clauses which dealt with the auditing of the Company's accounts. They were as follows:

CLAUSE 36.

(1) The Directors of the Company may, if they think, in any year appropriate out of the revenue of the Company as part of the expenditure on revenue account any sum not exceeding an amount equal to 1 per cent. of the paid-up capital of the Company, including premiums, to a fund to be called "the special purposes fund."

(2) The special purposes fund shall be applicable only to meet such charges as a chartered accountant or an incorporated accountant, being an auditor of the Company, or appointed for the purpose by the Board of Trade, shall approve as being—

(*a*) Expenses incurred by reason of accidents, strikes, or circumstances which due care and management could not have prevented; or

(*b*) Expenses incurred in the replacement or removal of plant or works other than expenses requisite for maintenance and renewal of plant and works.

(3) The maximum amount standing to the credit of the special purposes fund shall not at any time exceed an amount equal to one-tenth part of the paid-up capital of the Company, including premiums.

(4) The moneys forming the special purposes fund, or any portion thereof, may be invested in securities in which trustees are authorized by law to invest, or may be applied for the general purposes of the Company to which capital is properly applicable, or may be used partly in the one way and partly in the other.

(5) Resort may from time to time be had to the special purposes fund, notwithstanding that the sum standing to the credit of the fund is for the time being less than the maximum allowed by this section.

CLAUSE 48.

The prescribed number of auditors shall be one; but the number may be increased to two by a resolution of the Company passed at a general meeting, and such auditor or auditors shall be a member or members of the Institute of Chartered Accountants, or the Society of Incorporated Accountants and Auditors, and need not hold shares or stock in the Company.

Continuing, Counsel said that the two bodies he represented were perfectly satisfied with the clauses in question. These, however, had been altered by agreement between the promoters and the London Association of Accountants, to the effect that the auditors should be selected from an incorporated body or society of accountants, and that the choice should not be limited to the two bodies mentioned in the clause with regard to the Company's general accounts, and that the special purposes fund should be audited by an accountant, either being an auditor of the Company, or appointed for the purpose by the Board of Trade, instead of being limited to a chartered or an incorporated accountant. Counsel suggested that, as the matter in dispute was on a somewhat narrow technical point, the Bill should go before the Lord

Chairman. He wished to oppose any alteration in the Bill as originally drafted.

Mr. R. H. Fox (Messrs. Torr, Durnford, and Co., Parliamentary Agents) for the promoters, said that the matter had been before the Lord Chairman, and he had decided that it should be dealt with by the Select Committee.

Mr. Fitzgerald said that it was essential for the protection both of the shareholders, and still more of the gas consumers, that the accounts of the Company should be fairly and properly audited by a person well fitted for the purpose. At present, anybody was entitled to call himself an accountant, whether he was fit for the work or not; and it was felt many years ago that some provision ought to be made to ensure, as far as possible, that they should be persons who understood their business, and had been trained to it. In 1880 the Institute of Chartered Accountants was established by Royal Charter, and five years later the Society of Incorporated Accountants and Auditors was incorporated; and he submitted that these two Institutions embraced between them the great bulk of accountants in the kingdom. Some of the members of the London Association of Accountants had been unable to pass the examination necessary to become members of the two societies which he represented. With regard to clause 36, dealing with the special purposes fund, he understood that an alteration had been made last year in the Model Clause dealing with this matter, on the representation of the London Association of Accountants. There was not so much objection to this as to clause 48, which was much more serious. The result of the modification of the clauses as suggested by the London Association he maintained would be to let n practically everyone who liked to call himself an accountant, whether or not he had any knowledge or training as an accountant.

Mr. *G. Colville*, the Secretary of the Institute of Chartered Accountants, gave evidence in favour of the clauses remaining as originally deposited, and testified to the stringency of the examinations which would-be members of his Institute had to undergo.

Mr. Freeman, in cross-examination, said that the effect of the clauses as they originally stood would be that no accountants except members of the two societies named would be able to audit the accounts of the Company or of the special purposes fund.

Witness said that this was not so in the case of the clause dealing with the special purposes fund, as it was open to the Board of Trade to appoint the auditor for this purpose. He was willing to retain the Model Clause of 1914.

Mr. Freeman remarked that the Bill, as amended by his Association, represented the wishes of the promoters.

Mr. Fitzgerald did not agree with this. He said that the Bill, as originally deposited, represented the wishes of the promoters. They had altered the clauses in favour of the London Association of Accountants in order to get rid of their opposition. He added that the original clause had been included in Parliamentary Bills for years.

Mr. *James Martin*, Secretary of the Society of Incorporated Accountants and Auditors, gave similar evidence to that given by the previous witness.

In answer to a question from the Chairman, he said that he had never seen in any Government or Departmental Orders any societies mentioned for this purpose other than the two in question. His object in appearing was to prevent the London Association of Accountants from saying that they had parliamentary sanction.

This closed the case for the Institute of Chartered Accountants.

Mr. *H. A. G. Lewis*, the Secretary of the London Association of Accountants, Mr. *W. Colin Grant-Smith*, a member of the Association, and Mr. *C. H. Smith*, a Past-President of the Association, gave evidence in support of the clauses as amended.

Mr. Freeman, addressing the Committee, said that there were a great number of competent men in the kingdom following the profession of accountants who were not members of the two Societies mentioned, who would be available to be employed by any private individual; and why were they all to be excluded from following their professional vocations with regard to parliamentary companies? He did not see why two bodies should be entitled to altogether shut out all the people who were not members of them. It was now time that this monopoly should be broken down, and no favour be extended. It was ridiculous to say that the London Association of Accountants had not good and responsible men in its membership – men who were responsible for hundreds of thousands of capital, and who were connected with some of the largest commercial concerns in the kingdom. He maintained that a company should not be confined to two bodies in this way, against its wishes.

The Hon. Evan Charteris said that there was a representative of the Board of Trade present to give evidence with regard to this matter. As the Board was the Government Department which had control of all matters relating to companies and finance generally, the Committee might care to hear what the views of the Board were on the point.

The Chairman said he did not think the Committee would require to hear him.

The Committee deliberated in private, and subsequently

The Chairman announced that the Committee were of opinion that clause 36, with regard to the special purposes fund, should be amended so as to correspond with the clause in the Model Bill—*i.e.*, that the accountant be appointed by the Board of Trade. Clause 48 would remain in the form in which it stood when originally introduced.

The preamble of the Bill was then proved; and it was ordered to be reported for third reading.

LLANFAELOG WATER BILL.

This Bill came last Wednesday before a House of Lords Committee, presided over by the Marquis of Bath. It proposes to authorize the Valley Rural District Council to obtain a supply of water from the Bodsuran stream and from other streams and springs in the Parish of Llechcynfarwydd, in the County of Anglesey. The main object of the new supply is to transmit the water to Rhosneigr.

Mr. Courthope Munroe explained that at present there was no proper water supply at Rhosneigr. As a matter of fact, the Medical Officer of Health and the Local Government Board have urged the Council to take the question up. Under the Bill the sum of £20,000, repayable in sixty years, was asked for in respect of land and new works, and £5000 for new mains and services, repayable in thirty years. Negotiations with the Holyhead Water Company had been going on. They had, however, fallen through on the matter of price; and the scheme now put forward was one out of nine which had been investigated. The only opponent is Mr. E. J. W. Platt, who owns a 250-acre farm adjoining the stream. He alleges that the compensation water suggested under the Bill is not sufficient. The reservoir proposed would have a capacity of 284 million gallons.

For Mr. Platt it was contended that the capacity should be 59 million gallons in order to ensure compensation water to the extent of 170,000 gallons per day, which was the amount claimed. Under the Bill, the quantity would be 56,000 gallons per day.

Eventually the Committee decided to pass the preamble of the Bill, with the compensation water clause unaltered, except for the provision of bye-passes for the water to flow into the river below the gauges.

LEGAL INTELLIGENCE.

LIABILITY FOR REINSTATEMENT OF PAVEMENT.

Action against the Commercial Gas Company.

In the Bow County Court, on Monday of last week, before his Honour Judge Smyly, K.C., a case dealing with the liability of gas companies for the reinstatement of pavements after pipe-laying was heard. The plaintiff was Mrs. Ellen Braine, of No. 106, Canton Street, Poplar, who sued the Commercial Gas Company to recover £50 for personal injuries.

Mr. Abinger appeared for the plaintiff; and Mr. Cassel represented the defendants.

Mr. Abinger, in opening the case for the plaintiff, said that in August last the Company had taken up all the pavement in Canton Street for the purpose of laying gas-mains; and his case was that they replaced the paving stones in such a negligent manner that his client caught her foot against a stone that was raised 1½ inches above the adjacent one. She was thrown heavily to the ground, sustaining a number of bad bruises and internal injuries. She did not recover until Christmas. The Company were written to; but they denied liability. He had heard since that before the day of the accident, which occurred on Aug. 5, the Company had written to the Local Authority asking them to make good. It was obvious the Company were going to say that the Local Authority were liable; but the Gas-Works Clauses Act, 10 Vic., cap. 15, section 10, said that they (gas companies) shall, with all convenient speed, make good the road, tunnel, pavement, or wherever an excavation had been made. There was an express statutory order thrown on the company that when they excavated they must put into repair. As to the local authority, the Metropolis Management Act, 1855, section CXIV., laid it down that when the soil was broken it should be expedient for the vestry to fill in any excavation, without waiting for the gas company; and the cost should be borne by the gas company. It would be seen that it did not compel the local authority to make good, but only if they thought fit. The local authority could only be liable for an act of misfeasance. At the time of the accident, the local authority had done nothing to remedy the defect caused by the Gas Company. Therefore he submitted the Company's liability had not ceased. If the Company had any claim for reimbursement against the local authority, it had nothing to do with him. As a fact, this was the first case of its kind that had come before the Court. A case that had a somewhat important bearing on it was *Cressy v. South Metropolitan Gas Company*.* In the case of a local authority exercising their right to reinstate the pavement, the gas company were not liable. The distinction would be seen, as in that case the authority had carried out the work. They had done it wrongly, however; and the plaintiff brought an action, but elected to sue the gas company. The Judges of the Divisional Court said that the Metropolis Management Act changed the condition of things. The local authority, having exercised their right, were guilty of the misfeasance, and were liable, and not the gas company. In the present instance, no one had interfered; and as the Gas Company had done nothing, he held they were liable.

The plaintiff was then called and gave evidence as to her injuries. Her husband also gave evidence. He said he believed the local authority put the pavement right five or six days after the accident. He had no knowledge that the Gas Company were doing a lot of gas-main repairing, and that the local authority were following them up, street after street.

This closed the case for the plaintiff.

Mr. *Frederick W. Brown*, District Engineer to the Commercial Gas Company, said that on July 24 they received a notice from the Poplar Borough Council saying that some repairs were proposed in various streets, and asking that the Gas Company would do any needed repairs to mains, &c., so as to prevent the pulling-up the newly-laid pavement.

Mr. Abinger: I must call your Honour's attention to this. It is a very serious matter, as this document has never before been disclosed. We have been kept unfairly in the dark.

His Honour: It certainly ought to have been.

Witness, continuing, said they started work in Canton Street on the 25th, and finished on the 28th, when the trenches were filled in and the pavement put back.

Mr. Cassel: And after that, what is the practice between yourself and the Borough Council?

* See "Journal," Vol. XCIV., p. 590.

His HONOUR: Their practice has no bearing on this case. It is simply a question of what was done. The local authority are given a right to make good the pavement; but there is no statutory order on them, like there is on the Gas Company.

Mr. CASSEL: I submit that this of such great importance to gas companies that I am entitled to ask what the practice is.

His HONOUR: The practice is absolutely immaterial unless you show that it was followed in this case.

Witness went on to say how they laid the pipes, filled in, put the pavement down, and then informed the Council, asking them to make good. The Council had all the time been following them up, from street to street, making good.

In cross-examination, witness said he believed that it was Aug. 11 before the Council cemented the pavement. He thought the Company's responsibility ceased two days after the notice had been sent. Although it was a fortnight before the work was carried out, he did not consider it his duty to call anybody's attention to the matter. The pavement was inspected from time to time before the work was carried out, and it was always good.

A number of witnesses were called as to the carrying out of the work, and all of them agreed that the pavement was done properly by the Company.

Mr. *Malin*, confidential clerk to the Borough Surveyor of Poplar, said that an order was sent to the foreman on July 29 to do the work, which was carried out as soon as possible.

Mr. ABINGER: Counsel is trying to show that the Statute is imperative, whereas it is voluntary on the part of the Borough Council.

His HONOUR: It is clear that it is voluntary.

Mr. CASSEL said the main point in the case was extremely serious to gas companies; and that was upon whom did the liability rest for an accident on Aug. 5. The point had never been raised before. When water and gas companies were allowed to interfere with roads, it was made statutory that they should re-instate. This was in 1847. Then came the Metropolis Management Act of 1855; and section 114 made it lawful for the local authority to do the work, and take it out of the gas company's hands. It was perfectly true that it was voluntary; but it was also clear that a definite line would be taken, as had been done—and that was that the local authority would do the work without the passing of a solemn resolution in Council in each case. The legislation of 1855 prevented the Gas Company from making good. The thing was where and when did the responsibility of defendants end. It had to be remembered that the Gas Company had not been allowed by the local authority to permanently make good. Had they to sit astride a paving stone waiting for the Council to do their work? If so, it would need a reconstruction of the present method of construing the section. He contended that the Company had done everything they possibly could. They were not allowed to make good permanently—they just had to put the pavement down and then hand it over to the local authority. This they had done.

His HONOUR announced that he would give his judgment later.

MAINLAYING AT HARPENDEN.

A Decision by the Magistrates.

The St. Albans County Magistrates (Mr. R. Lydekker in the chair) were called upon recently to adjudicate upon a difference between the Harpenden Gas Company and the Urban District Council, respecting a plan for opening up a street under the control of the Council and laying a gas-main. The plan had been submitted by the Company to the Council for their approval; and, having failed to secure it, the Company now asked the Justices to determine the differences, pursuant to the provisions of the Gas-Works Clauses Act, 1847.

Mr. R. S. NOLAN appeared for the Company; and Mr. F. N. KEEN represented the Council.

Mr. NOLAN said the Company was incorporated in 1901. The existing main was for a certain distance along the route concerned a 10-inch one, then 8-inch and 6-inch, and afterwards part 4-inch. The Company wished to construct a separate main from a certain spot, and to continue it for 100 yards under the footpath. Then for a considerable distance it would have to go under the road itself; and then be continued for 135 yards under waste land by the side of the road. The Company supplied the residences and the public lamps from the main which already existed under the road; and their principal consumer was a rubber works, with a consumption of gas sometimes amounting to 6000 cubic feet per hour. Consequently, the general supply at times suffered. There had been frequent great fluctuation; and in some instances the public lamps had gone out altogether. In these circumstances, the Company considered it necessary to lay a new main on the opposite side of the road, and almost under the footpath or the waste land; and on Sept. 4 of last year Mr. F. W. Taylor, the Company's Engineer, wrote to the Council's Surveyor, informing him of the proposal, and asking him to confer as to the site, depth, &c. The Company's contention was that there was no power conferred upon the Council to take the course they had adopted, because what they had done was to oppose altogether the laying of the main. Mr. Taylor and the Surveyor met; and though, of course, the Surveyor had no power to bind his Council, there was no doubt he approved of the plan. But on Dec. 29 the Highways Committee disapproved of the plan; and on their recommendation the Council decided likewise. The Council required the Company to remove the present main and lay down a larger one, which was really dictating to the Company what they should do. The Company wanted to have two mains. The main proposed to be laid down by the Company was an 8-inch one running almost entirely under the footpath or under the road waste. The Company could not entertain the Council's suggestion, because it would mean a main of longer extent, and of the same diameter as the other two. The existing main was under the road, over which there was a considerable amount of traffic; and there was far more risk of damage to the main as well as of leakage, and of repairs being necessitated, with greater public inconvenience. It was a growing practice, wherever possible, to lay gas-mains clear of traffic; and local authorities were frequently petitioning against Gas Bills, to secure a clause compelling the laying of mains otherwise than beneath roads. This particular road had recently been metalled; and it was unnecessary to break it up again. The Company's plan of mains by the side of the road would mean shorter service-pipes, and private consumers would not have any disturbance from the fact of the rubber works being supplied. Apart from these and other reasons, he submitted that the Council had really no power at all to oppose.

Mr. *F. W. Taylor*, the Engineer and Secretary of the Company, who was the first witness, said the new main was absolutely necessary, and to lay a 12-inch main in the road, instead of relying on the existing one and the additional one proposed, would be attended by great risk of leakage. The two mains would be cheaper than one big one, though there was not a great deal of difference in cost.

Cross-examined, witness said there had been no breakage of the existing main. The depth of the main at the side of the road would be so arranged as (in the event of houses being erected) to miss the drainage connections. It was proposed to continue the main later on to an area which was likely to develop.

Mr. KEEN said this meant that it would cross the road and raise the whole question again—interfering with the water-mains and sewers. In the road already there were the District Council main sewer, the surface water sewer, and the Water Company's mains.

Mr. *William Phillips, Jun.*, of Luton, expressed his approval of the Company's plan for dealing with the problem, and spoke of the advantage of having two mains. They would, he said, put in the second main more expeditiously than if they took up the existing pipe and laid a larger one. To adopt the latter course would mean the disconnecting of separate house supplies and connecting with the large main as it came along. It would necessitate the opening-up of a larger surface of the road, it would take longer to do, it would knock the roads about more, and it was sure to be a good deal more inconvenient to the public. The connection between the proposed new main and the existing main would benefit the consumers who were supplied by the existing main. He had a list of the districts in his own neighbourhood where two mains were laid on the sides of the road. There were fifteen streets altogether.

Mr. *J. H. Leverton*, the Surveyor to the Council, stated that when Mr. Taylor suggested to him laying the new main from the existing main to the rubber works, they met quite unofficially. He raised no objection to the arrangement proposed, if there was to be a separate main; but he told Mr. Taylor he thought it would be much better to enlarge the existing main. The Council recently had had a great deal of trouble and expense in connection with laying pipes—such as sewers, storm-water drains, drainage pipes from houses, &c.—and they had come to the conclusion that the time had arrived when these things should be done more methodically, and that one side of the carriageway should be for the water-main, the other side the gas-main, and the centre of the carriage-way left for sewers and surface-water sewers. Quite recently they had had an application from the Postmaster-General for the footways to be used for underground cables for telegraphic and telephone purposes; and frequently during the last two years there had been mentioned the probability of an Electric Lighting Order, which, if it came to anything, would probably mean a further disturbance of the footways. They had recently laid new sewers in this locality, and had ascertained as far as possible where the gas-mains were, with the view of designing a system of sewers so as to miss the existing gas-mains. But shortly after the sewer work was put in hand, they had quite unexpectedly come across other mains that not even the Gas Company themselves knew the existence of; and the Council had had to execute extra work to deal with them. It had cost the Council £200 in diverting the gas-mains and altering the sewerage scheme. The multiplication of situations in which pipes were placed was the greatest nuisance in the world to a road surveyor. These proposals of the Company would add to the nuisance.

Mr. *Arthur Valon*, of Westminster, said he did not think the Justices ought to sanction the Company's plan. It was not desirable to put down two gas-mains in a comparatively small road such as this; and there was no doubt it was becoming increasingly difficult to arrange for the accommodation of the necessary mains in particular roads. If it were arranged for each company to have one place in the roads, this would be the best plan. As against the clear detriment that would be caused to the public interest by the adoption of the Company's suggestion, he did not see that there would be any overbalancing advantage to the Company. He could scarcely perceive where they could gain anything at all.

The CHAIRMAN (after the Magistrates had conferred) announced that they considered the plan suggested by the Gas Company was preferable to that of the Council; and therefore they sanctioned it.

Mr. NOLAN made an application as to special costs; but only Court costs were allowed.

Inquiry into a Gas-Worker's Death.

At the West Ham Coroner's Court, on Friday last, Mr. G. E. Hilleary held an inquest on the body of William Bonnott, a gas-works labourer. Deceased's son identified the body as that of his father, who, he said, was a healthy man, and was not subject to fainting. William Bailey, foreman in the purification department of the Gaslight and Coke Company's works at Bromley-by-Bow, said the man had been employed by the Company about forty years. He started work on Wednesday morning alone, washing down seals on 24-inch mains. Later he was informed that deceased had been taken bad, and found him lying on the ground quite unconscious, with bruises on the right side of his forehead and nose. Artificial respiration was tried, and oxygen was administered; but he never recovered consciousness. There was no leakage of gas—nothing at all extraordinary. The cock was half-way open, and it would be his duty to open it and get the water out of the pipe. The cock was in perfect working order. James Ready, a fitter's labourer, said the place was well lighted and ventilated. He found the deceased on his knees by the half-open cock. He thought

he must have fallen on it, and thus inhaled the gas. The place was not at all slippery. Dr. Fearnley said he had made a post-mortem examination, and there were conclusive signs of carbon monoxide poisoning; the blood being of a bright cherry colour. The cause of death was asphyxia. The Jury brought in a verdict of "Accidental death," adding as a rider: "We think more precautions ought to be taken, and that two men ought to be on work like this where there is any danger."

A Gas Company's Generosity.—In the Bow County Court, last Wednesday, before his Honour Judge Smyly, K.C., an application under the Workmen's Compensation Act was made on behalf of Geo. Webb, a labourer, who had been in the employ of the Gaslight and Coke Company at the West Ham works. On Aug. 31, 1912, he was loading a barge when a grab fell on his leg, breaking it. He had been receiving compensation; but on March 7 it was agreed that he should have £25 in full settlement of all claims against the Company for compensation. Mr. A. A. Robinson, who appeared to support the application that the agreement should be accepted, said the Company had generously consented to place the man on the pension list. The agreement was really a payment of 10s. 6d. a week, in addition to the lump sum. Judge Smyly: He gets his pension earlier than he would have done. Mr. Simmons (for the Company): It is a gift by the Directors. He was not entitled to a pension. Judge Smyly: Then I will certainly assent to the terms. Mr. Robinson: The costs have been agreed at £5 5s. Judge Smyly: The Company have acted generously in this case.

Plea for Cheaper Gas at Manchester.

The Manchester and District Smoke Abatement League have issued a letter asking the City Council to reduce the contribution of the Gas Committee in relief of rates from 1⅜ to 1½ per cent. on the capital of the undertaking, on the ground that a cheaper gas supply is the only solution of the smoke problem. In a summary of the arguments, the Chairman of the Committee of the League (Mr. E. D. Simon) points out that the contribution of the Gas Committee in relief of the rates is nothing but a tax on the 185,500 users of gas, and that the suggested reduction can be carried out without any increase in the rates. The amount of gas consumed in cookers and heaters in Manchester during the past year was equivalent to about 70,000 tons of coal. About 5 per cent. of coal burned in open grates passed into the air in the form of soot; so that gas fires and cookers last year saved an extra 3500 tons of soot from being poured into the atmosphere of Manchester. A slight reduction in the price of gas, it is contended, would result in a large extension of the use of gas-fires.

Slot-Meters as Savings Banks.

With the completion of the payments of last half-year's gas accounts comes the readjustment between the Gas Department at Bradford and the consumers who use penny-in-the-slot gas-meters. Speculation has been rife in the city during the past week or so as to the destination of Corporation officials carrying bulky packages of money, and the explanation has been forthcoming by the announcement that these bags contained change to be distributed to the slot-meter consumers. People using these meters in Bradford look upon them as a kind of savings bank, placing therein week after week any spare coppers which they may have; and when six months have expired and their gas accounts are settled, there is a sort of dividend day such as there is at the co operative stores. In six months a few weekly coppers mount up to a nice little sum. But the consumers run the risk of losing some of their savings, because the meter may go wrong and more gas be thereby used; and, of course, this has to be paid for. Generally speaking, however, careful housewives in Bradford use these meters to save a little for a rainy day. On this occasion they will obtain more money than they have saved—in fact, something in the shape of interest—because when the price of gas was reduced in the city the authorities did not care to alter the mechanism of the meters owing to the expense which would be involved. Therefore, the slot consumers have been receiving their gas at the old price, and the reduction in these cases will be paid to them in a lump sum. An interesting fact about this meter saving is that practically all the pennies inserted are good ones and as new as possible, because the users have got the notion that a thick penny ensures a longer supply of gas than a thin one.

Lighting Question at Lyndhurst.—For some time past the Lyndhurst Parish Council and many of the residents have been endeavouring to arrange with the Southampton Gas Company to extend their mains to Lyndhurst; and last Thursday week there was a public meeting to consider the matter. There was a large attendance; and a resolution was unanimously passed asking the Company to provide a supply of gas at the earliest possible date. In the course of the proceedings, Mr. J. R. H. Jacobs (the Secretary of the Company) explained that the total cost of bringing a supply of gas to Lyndhurst would be about £12,000; and to pay a fair rate of interest on the capital, there must be a consumption of from 5 to 6 million cubic feet a year at the outset. If the Company could secure this consumption, they thought they could supply gas at 4s. 6d. per 1000 cubic feet.

The "Greater Manchester" Scheme Abandoned.—The proposal to amalgamate Failsworth with Manchester has—like that in connection with the neighbouring district of Prestwich—been abandoned. Correspondence has passed between the Parliamentary Sub-Committee of the Corporation and the Urban District Council of Failsworth; the result being that the former body have passed a resolution which states: "That, in view of the adverse vote of the parochial electors of Failsworth, and of the amended petition now submitted of the Urban District Council to the House of Lords against the Manchester Corporation Bill, the Council be recommended to withdraw the application to the Local Government Board now pending for the inclusion of Failsworth within this city." Manchester and Salford have mutually agreed to abandon their schemes of incorporation with Prestwich, as the result of a conference of representatives of the two Councils.

MISCELLANEOUS NEWS.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Directors' Report.

The report for the half year ended Dec. 31, to be submitted to the proprietors at the half-yearly meeting to be held at the offices, D'Olier Street, Dublin, on Tuesday next, states that the total revenue amounts to £168,682, and that the expenditure, including interest on loan capital, &c., amounted to £144,655, showing a profit of £24,027. The prolonged labour disputes, which for a time paralyzed the business of Dublin city, and closed the port, and the difficulty and additional expense in obtaining coal, seriously affected the receipts on the one hand and the expenses on the other. In addition, it was found impossible to obtain delivery of the new sulphate plant during the time the port was held up; and, consequently, the manufacture of sulphate of ammonia was interrupted for a considerable time. In the circumstances, the Directors do not feel justified in recommending a higher rate of dividend on the consolidated stock than 2½ per cent. per annum, payment of which will absorb a sum of £18,266.

In accordance with the understanding come to at the last half-yearly general meeting, Mr. W. Newbigging and Mr. W. R. Herring, two gas engineers of undoubted ability and eminence in their profession, were appointed to examine and report on the state of the Company's affairs. Every facility was afforded them of making a thorough investigation; and a report has been made which will receive the fullest consideration by the Directors.

The Directors understand that a strong feeling exists among the stockholders that three new Directors should be elected to the Board at the general meeting. Mr. Charles Lawler, who has been a Director of the Company for over thirty years, retires by rotation, and, owing to continued ill-health, does not seek re-election. This retirement will cause a vacancy; and two other vacancies on the Board which have been unfilled for a considerable time, will enable the three new Directors to be elected as desired. The present Directors would welcome the accession to the Board of any three gentlemen approved by the stockholders, in the choice of whom they in no way desire to interfere.

A statement appended of residual products for the half year shows that there were in store on June 30 last 3674 tons of coke, made during the half year as estimated 28,269 tons, used in manufacture as estimated 7627 tons, and sold 21,894 tons; leaving 2422 tons in store on Dec. 31. Of 5034 tons of breeze made, 2712 tons were used in manufacture. Of tar, 514,971 gallons were made as estimated, and 311,558 gallons were sold; the quantity in store in December being 746,650 gallons. Of ammoniacal liquor, 1,203,850 gallons were made as estimated; and the quantity in store was 1,571,127 gallons.

A statement of gas made, sold, &c., shows that of common gas 832,161,000 cubic feet were made, including 239,918,000 feet of carburetted water gas. The quantities sold were: Public lights and under contracts (estimated), 51,318,000 cubic feet; private lights per meter, 675,294,000 cubic feet; total sold, 726,612,000 cubic feet. The quantity used in works, &c., was 10,255,000 feet; the total quantity accounted for, 736,867,000 feet; and the quantity not accounted for, 95,294,000 feet. The number of public lights is given at 6492.

NEW VERTICALS AT WEST BROMWICH.

On Friday afternoon, the members of the West Bromwich Town Council visited the gas-works, on the invitation of the Chairman of the Gas Committee (Mr. J. Brockhouse), for the purpose of inspecting the new vertical retorts which are now nearing completion, and which will displace the horizontal retort system that has been in operation since the Corporation began the manufacture of gas there.

The party were received by the Gas Engineer (Mr. Harold E. Copp), and his Assistant (Mr. H. Cox). They first of all inspected the old horizontal retorts, and were afterwards introduced to the new buildings in which the vertical system was in operation. This, together with the plant, has entailed a total expenditure of £18,500. In the explanation of the new system, Mr. Copp was assisted by Messrs. Cloudsley and Tarrant, of the Woodall-Duckham Company, the Contractors. The new installation consists of twenty vertical retorts, capable of carbonizing 100 tons of coal, and giving an output of 1,200,000 cubic feet of gas, per 24 hours.

At the close of the inspection, light refreshments were provided by the Chairman and members of the Gas Committee. Mr. Brockhouse said he hoped the members of the Council were satisfied that they were getting good value for the money they were spending at the works. They all, he was sure, deeply regretted that Mr. Copp, after having done all the "spade work" in connection with the introduction of this improved system, was leaving them. During the twelve months the work had been on hand, Mr. Copp had had a most strenuous time. He had been in the midst of deplorable labour troubles, which had delayed the Contractors, who, had it not been for that, would no doubt have completed their task by the beginning of November last. They had one of the most complete installations in the country; and they ought to feel proud of this fact. [Applause.] On behalf of the Committee and the Council, he complimented the Contractors and Mr. Copp. They wished Mr. Copp all success in his new sphere of labour. The Mayor (Mr. C. S. Bache) endorsed the remarks of Mr. Brockhouse with regard to Mr. Copp, and said they were losing a man who had seen them through many difficulties in the past, and had put them in a position to face anything in the future. After the great ability he had shown, they would have greatly liked him to have remained with them. He was surprised upon going round the works to see the excellent manner in which everything had been arranged.

Mr. Kenrick spoke in a similar strain. Mr. Cloudsley and Mr. Copp returned thanks. Mr. Copp expressed his indebtedness to the members of the Committee and the Council for the great kindness they had always shown him since he had been in their service. He was perfectly satisfied that they had a very excellent plant; and such systems as the one they had adopted were the coming thing for gas-works. The new retort-house was illuminated by high-pressure gas; and if they could introduce this with success in a place where there was so much vibration and dust, they could put it anywhere.

MACCLESFIELD GAS-WORKS EXTENSIONS.

The Gas Committee of the Macclesfield Corporation have had before them a report by the Gas Engineer (Mr. W. Newbigging) on a proposed extension of the gas-works, to enable them to deal with a considerably increased demand for gas. Last year 7 million cubic feet more gas were sent out, and upwards of 1300 tons more coke sold. A total expenditure of upwards of £2300 was foreshadowed. Mr. Newbigging submitted an alternative estimate of £1750, which was, he said, the minimum with which he could manage at the present time. A proposition was made that the larger scheme should be proceeded with; but this was not carried, and the smaller one, involving an outlay of £1750, was decided upon, and it is to be commenced at once. It comprises the removal of three cottages and the building of a boundary wall for the coke-store, and the provision of a new weigh-bridge and foundations in the bottom yard, a steam-boiler in the retort-house, and larger exhausting plant.

In the course of the proceedings, a question was asked in regard to the vertical retorts, which it was rumoured were not working satisfactorily. The councillor who made the inquiry said his reason for doing so was that very serious statements were being made about the retorts. Mr. Newbigging replied that they were entirely unfounded, and were libellous. They emanated from the men who had been discharged, or whose services had been dispensed with, as they were not required to work the new plant. It was not unusual to hear such reports in like circumstances; but there was absolutely no truth whatever in them.

CHRISTCHURCH (N.Z) GAS COMPANY'S JUBILEE.

Congratulations to the Christchurch (New Zealand) Gas Company, who have done fifty years' good work, and so are now celebrating their jubilee. As the result of a preliminary meeting in 1862, a Company was formed with a capital of £10,000, in £10 shares. The first Chairman was the late Mr. J. M. Heywood; and the first Engineer was the late Mr. E. G. Wright, who afterwards, from 1877 to 1902, was Chairman. The first Secretary was Mr. (now the Hon.) E. C. J. Stephens. The capital of the undertaking now stands at £240,000. There have been in all eight Chairmen; the latest being Mr. F. Graham. Only three Secretaries have held office from 1863 down to the present day; the one now in office being Mr. R. C. Bishop.

When, in 1864, the first gas was available, the capacity of the holder was 10,000 cubic feet; whereas now the storage accommodation is nearly 2½ millions. At the start there were only two or three miles of mains laid along certain of the city streets; and for seven years afterwards the extensions amounted to only 1¼ miles. Since, then, however, the operations of the Company have received a decided acceleration; and at the present time the mains laid in the city and suburbs have a length of 200 miles. During the first year of active work 2,500,000 feet of gas were sent out; but last year the amount produced and distributed was 355 millions. In 1866, the distribution for a four weekly period was 87,000 cubic feet; in 1913, for the same four weeks, the distribution was 36 millions. In 1871, the largest daily output was 23,000 cubic feet; now 1¾ million feet can be produced in a day. The price of the gas when first distributed was 20s. per 1000 cubic feet; now the price is 5s. 9d. for lighting and 4s. for power. The meters in use to-day reach a total of 14,000 to 15,000; and the coal carbonized runs into nearly 25,000 tons a year.

The Company have had a very fortunate career. The works have never been stopped on account of labour troubles, coal shortage, or from any other cause; and during the fifty years only one life has been lost—last year. For forty-nine years, there had not been a single fatality. In addition to being purveyors of light and power, the Company have established quite a big business in bye-products. Ammonia for freezing works and creameries is produced and disposed of in large quantities; and a considerable amount of liquid ammonia is also sold for wool-washing purposes. The Company have made a speciality of gas-cooking; and great headway has been made during recent years in this branch of the work. A demonstration-room, under the charge of an expert lady demonstrator, has been opened; and free lectures and demonstrations are given regularly. There are now about 80,000 mantles in use. In 1903, the Company introduced the system of providing them under very generous conditions; and the mantles given away in this manner total over 100,000 per annum.

There have been several changes of offices; and it was not until 1902 that the present imposing block of buildings was erected and occupied. This building contains three floors, each of which is devoted to different sections of the work of the Company. The ground floor contains the offices and the show-room. On the first floor there is a set of offices for the inspectors, canvassers, and the maintenance and distributing staff; and the demonstration-room is also on this floor. Above is the store. At the back of the main building are situated the workshops.

Manchester Corporation Salaries.—A special meeting of the Manchester City Council was held last Wednesday, principally to consider applications for increases of salary. The highest demands were made by the Gas Department. Their proposals included Mr. F. A. Price, Superintendent, £700 to £750; and Mr. J. R. Hill, Manager at the Bradford Road station, £500 to £525. These were agreed to.

GERMAN CONTINENTAL GAS COMPANY.

Annual Report and Accounts.

We have received a copy of the report and statement of accounts of the German Continental Gas Company for the year 1913, which will be submitted to the fifty-ninth annual general meeting, to be held at Dessau on Monday next.

In the year under review the gas consumption showed a still further increase—6·48 per cent., as against 6·09 per cent. in 1912—bringing the total up to 98,898,566 cubic metres [3,493,097,000 cubic feet]. The total profit increased by Mk. 239,291 to Mk. 4,688,509 [about £229,829]; so that a dividend of 11 per cent. can again be proposed, with an increase of reserve funds. The distribution of consumption was much the same as in the previous year. Some of the works showed a loss of lighting business, which, however, was easily made up by cooking and heating additions. Higher prices had to be paid for coal than in 1912, but coke and tar, the most important bye-products, fetched enhanced prices. Ammonia sales, to which the Company does not attach so much importance, showed rather worse results.

The electricity undertakings of the Company showed satisfactory increases; and the income from this source was more than doubled, owing mainly to the fact that several new works presented their first year's results. Other undertakings in which the Company has financial interests are in good condition, and promise to continue a valuable source of revenue. Only Mk. 46,719 was taken from the renewal fund during the year, as against Mk. 220,929 in the previous year. This, together with larger additions made, has put the total reserve, redemption, and renewal funds—£1,221,630—ahead of the share capital.

The following further particulars are given of the gas supply. Considerable increase of business in Alsace was ensured by the purchase of the municipal gas-works in Hagenau, and the signing of a fifty years' contract with the town. A concession for a similar period was obtained from the town of Trebbin, which it is intended to connect with the Potsdam district supply by a long-distance main. After protracted and difficult negotiations, the contract with Odessa has at last been completed, and has received the ratification of the Ministry at St. Petersburg. The gas-works have already been handed over to the Company, and the most urgent work in them started. Meanwhile plans are under consideration for the reorganization of the whole gas-supply system. Several new contracts for the supply of electricity were satisfactorily concluded, and this branch of the business promises continued expansion. The newly-formed Lower Rhenish Light and Power Company, of Rheydt, in which the German Continental Company has such large interests, has made an excellent start by paying a dividend of 5 per cent. for its first year; and 6 per cent. is estimated as the probable dividend for the current year. The Dessau Vertical Retort Company, after its successful litigation, and subsequent working arrangement with the firm of Julius Pintsch, is making satisfactory progress. The chemical factory Residua, of Frankfort-on-Main, in which the Company also held interests, went into liquidation during the year; its most important patents having expired. The Superannuation, Widows, and Orphans Fund has now a membership of 319, with a sum of over two million marks to its credit. The interest on the balances in public savings banks to the credit of officials and workmen of the Company were made up to 11 per cent. by the Company—equal to the dividend payable on the share capital.

Owing to the expansion of the Company's business, with the commencement of a gas supply in Odessa and increasing electrical activities generally, more capital has become necessary. It is therefore the intention of the Board to ask the permission of the general meeting for the issue of Mk. 6,000,000 of new bonds, and a raising of the Company's capital by a nominal amount of Mk. 4,200,000 by the issue of 3500 new shares of Mk. 1200. This would bring the share capital of the Company up to Mk. 28,200,000, and the value of outstanding bonds to Mk. 21,729,000.

OTTOMAN GAS COMPANY, LIMITED.

The War and its Results.

The Ordinary General Meeting of the Company was held last Tuesday, at the London Offices, No. 59, Gracechurch Street, E.C.—Colonel Stephenson R. Clarke, C.B., in the chair.

The Assistant-Secretary (Mr. C. J. Daun) read the notice convening the meeting, the certificate of the Auditors, and the minutes of the last meeting; and the report and accounts were taken as read. The latter covered the six months ended Dec. 31. For this period the gas-rental amounted to £28,392, compared with £24,746 for the same half of 1912; while the net profit was £6374, against £3645.

The Chairman, on rising, said he regretted that their esteemed Chairman, Colonel Daniell, had again been compelled by the doctor's orders to seek a warmer climate; and on his behalf, he (the speaker) desired to express to the shareholders Colonel Daniell's disappointment at not being present at the meeting. In the Chairman's absence, it devolved upon him to present the accounts to the shareholders; and he hoped that they would find them satisfactory. Considering the difficult circumstances through which the Company had struggled during the past year, he thought they might be so looked upon—at all events, as regarded the trading account. The war not only caused coals and freights to be far dearer than they would have been, even in the abnormally dear times of the past year, but it actually threatened to make them unobtainable; and if it had not been for the courtesy of the Greek Government, who granted passes to the vessels carrying coals for the Company, they would have been absolutely so, and the supply of gas would have become impossible. Happily this was avoided, though at a great cost. However, as a counterbalance to the increased expenses, he was pleased to be able to report increased sales of gas and coke. The war resulting in the cession of considerable tracts of

Turkish territory in Europe, had had the somewhat unlooked-for effect of increasing the population of the country behind Smyrna; many Turks having left their old homes in Europe and taken up farms in Asia Minor, sooner than transfer their allegiance to other states. This increase in population had resulted in a corresponding increase in the cultivation of the land, which again would bring further trade to the town of Smyrna, and an increase in consumption of gas to the Company. During the half year under review, they had paid £2560 more for coals. This was compensated for by an increase of £3646 in the gas-rental, and also by a gain of roughly £2000 in respect of residual products. Owing, no doubt, to hostilities, money had been more difficult than usual to collect. At present they had not invested the customary amount on account of the amortization fund; but it was hoped to do so shortly. As the amount standing to the credit of this fund was above its standard requirements, the Directors had no anxieties on this account. A company had obtained a concession to supply electricity for traction and for lighting in Smyrna. The latter the Board considered was an infringement of the Ottoman Gas Company's rights; and they were making a firm stand to obtain a just arbitration, or at any rate substantial compensation. With regard to the present half year, he might tell the shareholders that the prospect of the trading account appeared to the Directors to be distinctly favourable. In conclusion, he moved the adoption of the report and accounts.

Mr. A. M. PADDON formally seconded the motion.

Mr. R. L. ANDREWS inquired as to the nationality of the new electricity undertaking.

The CHAIRMAN replied that he understood it would be a Turkish Company. There was a movement in Turkey in favour of all concessions in future being made to companies registered in Turkey.

The resolution was then carried unanimously.

On the proposition of the CHAIRMAN, seconded by Mr. STRACHAN C. CLARKE, a dividend was declared for the half year ended Dec. 31 at the rate of 7 per cent. per annum on the preference shares (less income-tax) and at the rate of 10 per cent. per annum on the ordinary shares (tax free), leaving a balance of £7976 to be carried forward.

Mr. PADDON, in moving the re-election of the retiring Directors (Colonel S. R. Clarke and Mr. S. C. Clarke), remarked that both gentlemen possessed a long and honourable record in the service of the Company; and the results presented that day—which he ventured to think were far better than any reasonable person could have expected under the difficult circumstances—were largely due to the care and assiduity with which they had discharged their office during the period referred to.

The resolution was passed; and the Auditors (Messrs. T. H. Cooke and F. W. Church) were also re-appointed to their positions, on the motion of Mr. E. L. BURTON.

The CHAIRMAN, in proposing a vote of thanks to the Engineer and Manager (Mr. John Gandon), the Secretary (Mr. A. W. Cooper), and the whole of the staff in England and Smyrna, said there had been a great deal of anxious work to do during the disturbed times through which they had passed; and the shareholders might rely upon it that the fact that the Company had come out of it all with "flying colours" had been largely due to the constant efforts of those he now desired to thank.

Mr. ANDREWS, who seconded, remarked that the accounts spoke for themselves. He had been a shareholder in the Company for thirty years; and the present figures were the best he had ever seen. He subsequently proposed a vote of thanks to the Chairman and Directors.

Mr. BURTON seconded the vote, which was heartily accorded, and acknowledged by the CHAIRMAN.

AUCKLAND (N.Z.) GAS COMPANY.

Presiding at the fifty-second annual meeting of this Company on the 2nd ult., the Chairman (Mr. J. H. Upton) pointed out that on the receipts side of the revenue account there was an increase in every item; the total gain being £19,284, or nearly 11 per cent. On the other side, however, there was a growth of £19,028, or almost 15 per cent., arising from various causes—among them the strike, greater cost of coal, expense of altering mains in consequence of street improvements, demonstrations, &c. The balance of profit was £48,533. The gas-stoves in use numbered 9271—an increase during the year of 1581, or over five for each working day. The day was not far distant when no house would be thought to be properly equipped without a gas-cooker and its economy of time, labour, and money. During the past year, 26½ miles of new mains had been laid, making the total mileage 370. Among much work in progress, the new vertical retort-house was being pushed on as rapidly as possible. At Devonport, the vertical bench was in satisfactory operation; and when the coke-handling arrangements were completed, the scheme of reconstruction undertaken some years ago would have been carried out, and the works would be capable of extension, as might be required, to four times the present output, without any very serious capital expenditure. The shareholders need have no fear as to the maintenance of their dividend. The policy of the Company had been to lower the price of gas; and it was now very cheap. Therefore they could, if necessary, raise the charge somewhat. The report was adopted; and it was decided to raise the capital to £1,000,000, and to pay a dividend for the half year ended Dec, 31 of 11d. per share on the £1 fully-paid shares.

Skegness Water Supply.—Substantial financial results were reported at the last meeting of the Skegness Urban District Council in regard to the water supply; Mr. Vasey (the Manager) being congratulated upon the success attending the undertaking. It was pointed out that the concern, involving a capital of £45,000, had been worked during the twelve months at a cost of under £800. It has been resolved to reduce the water-rate for the ensuing year by 2 per cent. all round; meter-rents being at the same time lowered. Objection was raised to the creation of a reserve fund; it being claimed that ratepayers who had borne the burden of the expense should benefit by lower rates.

LEEDS SPECIAL COMMITTEE'S REPORT.

Discussion in the Council.

The Special Meeting of the Leeds City Council held last Wednesday for the purpose of considering the report of the Special Committee appointed to deal with all matters connected with the recent strike of municipal employees, proved insufficient to conclude the discussion, which, at the end of three hours, was adjourned until Friday of this week. Some extracts from the report, and the Committee's recommendations, were given on p. 759 of last Tuesday's "JOURNAL."

The adoption of the report and recommendations was moved by Alderman C. H. Wilson, the Chairman of the Committee, who said there was no justification for the allegation made by Mr. J. R. Clynes, M.P., of victimization by the Committee, contrary to promises made at the conference he had with the Committee during the strike. He pointed out that while Mr. Clynes was told that only about 1000 of the strikers out at the time of the collapse of the movement would be reinstated, the Committee had actually taken on 1386 of them. He explained that 500 men, respectable citizens of Leeds, were put on during the strike, and had proved themselves satisfactory, and under no circumstances would they be displaced. The other 500 men still out included those who were found to be unnecessary to the service. They represented the over-staffing in the various departments. The city of Leeds paid the best wages of any city in the United Kingdom; so there could not be any charge levelled against them that they were not paying a living wage or doing justice to the workmen. Every effort had been made to avoid the strike. The Lord Mayor (Mr. E. A. Brotherton) had offered to give £50 a week to charities, he (the speaker) had offered arbitration to Mr. Will Thorne, M.P., and more men had been advanced in wages in one year than in any previous five years. Arbitration was rejected without the men being taken into consultation; and the Council had been obliged to make a stand.

The other speakers at the meeting were labour members. One of these was Mr. W. Wood, who, in the course of a speech which was severely handled by his fellow councillors during its delivery, declared that the battle was not finished. He expressed his disapproval of the idea of the Corporation going in too lavishly for vertical retorts at present; saying that they were still in the experimental stage, and suggesting that the Corporation should wait until there had been five years' longer experience with them in other towns.

WEST HAM PUBLIC LIGHTING CONTRACT.

Some Outspoken Comments.

Speaking at a social gathering at Plaistow promoted by the South West Ham Burgesses' Association, Councillor Docksey made some piquant remarks on the public lighting contract, Socialism, and trade union finances. The following report of what he said is taken from the columns of the "Stratford Express."

Councillor Docksey said he would let them into a little secret with regard to the way in which the negotiations had been carried on as to the lighting of the streets, upon which subject there had been a discussion at the last meeting of the Town Council. In December the contract with the Gas Company expired; and the Council made inquiries as to the best terms upon which the Company would light the streets in the future. They replied, "We shall be able to supply you with an increased light, something like double the candle power, at 3s. 1d. per lamp less than in the past." So the meeting would see that the Council would be able to supply the public with a very much better light in the streets, and at the same time effect a saving in the rates. One of the Socialist members of the Committee suggested that they should have the Electrical Engineer in at the time, in order to see what he would do. They invited him there; and he said he would like the Committee to give him a block of streets to light as an experiment, and he would supply them with a 100-watt lamp, which was equal to 83⅓-candle power, at £2 12s. 6d. per lamp per annum. This would be 4s. 6d. per lamp more than the Gas Company would charge; and the light would be only two-thirds that of gas. The Committee made inquiries as to the price at which the Gas Company would supply 2500 lamps, which was rather less than they had quoted for; and they replied that it would be the same rate—£2 8s. per lamp for five years, and 5s. less for ten years. It was decided to let the Electrical Engineer supply 249 lamps at his price as an experiment; but some of their Socialist friends were not satisfied with this. They wanted to give him practically the whole of the north of the borough to light; and so it was decided at the last meeting of the Council to refer the matter back, in order to see at what price the Gas Company would supply the light for two, three, and five years. When the matter was before the Council, one of the Socialists "let the cat out of the bag," when he said, "We want to control the labour." That was what they were after every time. They wanted to get more men under their control, and get them into the trade unions, and draw their subscriptions. They "did not care a hang" about the Gas Company men being thrown out of employment; they wanted to get more men into their unions. What did it mean to them? He happened to have with him a copy of the balance-sheet of the Gas-Workers' Union, dated March, 1913. The contributions for that quarter amounted to £14,523; and the salaries of the Secretary and organizers and the general expenses came to £5787. So that they would see where the gas-worker would be when a strike came along. At the time there were 92,038 members; and how much did they think there was in the strike fund? Only £1579; and how much of this was "get-at-able"? Some of the money was invested in labour newspapers and trade union halls; and the available cash was only £909 17s. 4d., which was to be split up among more than 90,000 members. This did not amount to 2s. each. How long would it last if a strike was on? Was it any wonder that the dock strike, the coal strike, and the Leeds strike were failures when they saw that a large proportion of the income had been spent in

management expenses and salaries? This was Bill Thorne's union, and now he would deal with Ben Tillett's. Would they be surprised when he told them that the management expenses in one year, including the salaries of secretaries and organizers, amounted to £14,700, and the benefits paid out amounted to only £4200? This meant that the expenses were something like 350 per cent. on the benefits. Now they could see why men were urged to join unions, and they were almost compelled to, or they got the "order of the boot." The money was nearly all spent in salaries and expenses; and when the time of want came, there was nothing left for the poor man brought out on strike at the bidding of these agitators.

STREET AND ELECTRIC LIGHTING.

A proposal has been made to form an Electric Lighting Company for Street, providing that a promise was forthcoming from the Urban District Council for a contract for the electric lighting of the streets, for a definite number of years. A local firm (Messrs. C. & J. Clark, Limited), who made the proposal, suggested that by adding to the plant at their own works, they could supply the Company with current on favourable terms; and, further, they offered to take shares in the concern. Messrs. Christy Bros. and Co., electrical engineers, of Chelmsford, suggested that the Company should have a capital of £5000, and expressed their willingness also to take some shares.

Subsequently, on the proposal of Messrs. Clark, the matter was considered at a public meeting, in the course of which Mr. Frank Christy gave an outline of the scheme. He quoted figures from other places which he said led them to expect at Street (on an immediate outlay of £4000) a revenue of £900 for the first year, £1400 for the second year, and after that increases of £200 or £300 a year, until they reached £2000 or £3000. There were a large number of well-paid operatives in the town; and if arrangements were made to light the cottages in a satisfactory manner, the supply would no doubt be adopted. The usual charge for electricity was 6d. per unit, which compared favourably with gas at 3s. per 1000 cubic feet. The fitting-up of a cottage with four or five lamps would amount to £2 or £2 10s. Landlords might be induced to put the supply in, and the cost be arranged on a rental basis—charge the cottager (say) 6d. per week for two lights, and 1d. a week for fitting the two lamps. This would cost the cottager 8d. per week—quite as cheap as lamps or candles. A Provisional Order could be obtained from the Board of Trade, which would give them practically a monopoly for 42 years. After a number of questions had been asked and answered, it was decided that steps should be taken to form a Company.

Then the question came before the Council. When the Chairman (Mr. A. W. Stacey, J.P.) reported a recommendation by the Lighting Committee that, in the event of an Electric Light Company being formed, the public lighting should be handed over to them—"for a period of ten years," a member added. The proposal submitted by Mr. Christy was for lamps of not less than 50-candle power, to be lit all the year round from half an hour after sunset until 11 o'clock (11.30 on Saturdays), omitting three nights at full moon, at an inclusive charge of £2 per lamp per annum. This offer was made subject to the Council giving their consent to the use of overhead wires throughout the district; the wires to be subject to the approval and the regulations of the Board of Trade and of the Council. In reply to a question, Mr. Clark said his firm would not consider for a moment supplying the current in bulk to the Council instead of to a company. The scheme was not put forward to benefit the firm. If the Council took the scheme up, and had to provide all the mains, he did not think it would pay. At the end of 42 years the Council could take over the plant at a valuation of the materials only, with nothing for goodwill. A member remarked that 6d. per unit for electricity (the price suggested here) was equal to gas at 11s. per 1000 cubic feet. The proposal that the Committee's recommendation be adopted (the seconder adding, "For a ten-year term") was carried by eight votes to two, after the defeat of an amendment to the effect that the Council should not bind themselves until they were satisfied that electricity would be cheaper and better for the private consumers.

A FATAL ACCIDENT AT BECKTON.

Mr. G. E. Hilleary held an inquiry last Tuesday at the Coroner's Court, West Ham, relative to the death of John Race, a chemical labourer, lately employed at the Beckton Gas-Works.

Charles Strickland, foreman, said deceased was employed under him as a lime fixer, on the afternoon of the 4th inst., when the delivery-pipe became blocked. He ordered the foreman engineer to get a fitter, take the lever off, and clear the pipe. He afterwards went to the lime-shed, and found deceased had been scalded on the back and arms; and he had him removed at once to the Seamen's Hospital. He was working about 20 feet away from the pipe, which contained lime-water at about boiling-point. The man was wearing a flannel shirt and a cotton one; and had he had a waistcoat or a coat on, probably the accident would not have happened. The relief valve was in perfect working condition. When he heard that the pipe was blocked, the usual steps were taken to clear it—namely, by pouring water in to clear out the sand, and then forcing steam through it. The pipes frequently got choked—the cause being sand from the lime running down to the bottom. Race was warned of what was likely to occur when the steam was forced through. John Haynes said he helped to clear the pipe, and told deceased to be careful. The pipe had been cleared scores of times in the same way. The deceased had cleared it himself several times by the same method. But although he was warned, he did not on this occasion get out of the way quickly enough, and was therefore scalded when the steam came out. The House Surgeon at the

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WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.

SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 13, Whitworth Street West, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE, and 12 Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Seamen's Hospital said deceased was suffering from shock and severe burns on the whole of his back and both arms below the elbow. He did fairly well at first, but gradually became exhausted and died on the 13th inst., from septic absorption following the burns.

The Jury brought in a verdict of "Accidental death;" adding: "At the same time, the Jury are of opinion there was not sufficient precaution taken to obviate danger by the officials in charge of the job."

FLETCHER, RUSSELL, AND CO., LIMITED.

The Chairman and the Strike.

In opening the proceedings at last week's annual general meeting of the Company, the Chairman (Mr. George Perkins) referred to the strike in progress at their works. He said the men emphasized the fact that at one time they were allowed to approach the firm by deputation. During the past year, several deputations of workmen had been seen regarding complaints which had, generally speaking, turned out to be of a frivolous character, and which could easily have been dealt with by the foremen. The Directors therefore put up a notice in the works that any man having a complaint to make must mention the matter to the foreman of the shop in which he worked, and it would, if reasonable, receive consideration. Many of the shareholders would have read that the men at a mass meeting decided that, unless the right of deputation was conceded, work would be suspended. The meeting referred to could not by any means have represented the views of the majority of the workmen, as the room in which it was held only accommodated at the outside 300, and there were about 1000 employees in the works. Moreover, a number of the men present at the meeting were not employed by the firm; and yet they were allowed to vote for a strike in the works. He ventured to think that if a ballot of their workmen had been taken, there would have been a great majority against a strike. The men had no genuine grievance; and it was hoped that the Directors would have the support of the shareholders in their efforts to manage the business in their own way and free from outside interference. As to the accounts, the Directors were still continuing their policy of organization, concentration, and economy; and they thought the shareholders might congratulate themselves on the result of the year's working, and on the ample evidence of the decided improvement in the position of the Company, financially and otherwise. A larger business had been done, which also made for the satisfactory results achieved. The balance (after charging large depreciation) from the trading account, interest on investments, cottage rents, and transfer fees, amounted to £25,952. After deducting debenture interest and Directors' and Debenture Trustees' fees, and adding the amount brought forward, there was a total of £24,202. Deducting the interim dividend on the preference shares, there was available £22,702. The Directors recommended that a final dividend be paid on the preference shares for the six months ended Dec. 31; that a dividend of 5 per cent. be paid on the ordinary shares for the year; that a bonus of 5 per cent. for the year be paid on the ordinary shares; that the sum of £6919 be transferred to the reserve fund; and that the balance of £4282 be carried forward. The Directors also recommended to the shareholders the election of the Secretary, Mr. W. H. Rudge, to a seat on the Board. He had been connected with the Company from its inception, and had a good knowledge of the business.

Mr. Edmund Rowson, in seconding the adoption of the accounts, said he thought he ought to offer some congratulations to the Directors for what had happened during the past twelve months. In 1910 the cash in hand was £143; while to-day they found it amounted to £28,300. The Company had purchased 47 of their debentures as an investment; and the profits in 1910 were £2535, while to-day they were £21,145. These figures were all the more startling when he recollected a remark made at a strike meeting that the men made the profit, and that they should have it. He was of the opinion that it was the men at the head of affairs, and not the workmen, who made the profit. Whatever opinion they might have regarding the strike, he thought they would be unanimous that it was unfair, un-English, and unsportsmanlike. The conduct of men who interfered with others who honestly wished to work, and called it "peaceful picketing," must receive the condemnation of everyone associated with the Company.

The motion was carried unanimously; and the various recommendations of the Directors were agreed to.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The question of the old practice of the Edinburgh and Leith Gas Commissioners to have an annual dinner came up at their last meeting. The report of the Finance and Law Committee stated that a motion was carried to the effect that the Commissioners should have a dinner in their own offices, restricted to the number of Commissioners and guests that could be entertained there. Bailie Lyon moved approval of this report, on the ground that the dinner was necessary for the good control and management of the affairs of the Gas Commission. Bailie Stark said that there should be no dinner, as they had been told by their legal adviser that the cost was an illegal charge. Eventually the dinner was decided upon by 12 votes to 8. At the same meeting the question of the payment to the British Commercial Gas Association of the full contribution of 2s. 6d. per million cubic feet, which amounted to about £250, was agreed to, provided that two-thirds of this sum would be expended on local advertising to the Commissioners' satisfaction, and that it would be noted in these local advertisements that inquiries should be addressed to the Commissioners. It is understood that the British Commercial Gas Association are agreeable to accept the contribution on the terms stated. In reporting upon this matter, Mr. Herring and Mr. Masterton gave a list of various magazines, &c.,

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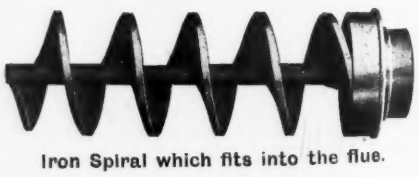
Internally Heated. Perfect heat transfer; products travelling 5½ feet in heating chamber surrounded by water.

Cleaned Without Disconnection.
Flue—by lifting out Iron Spiral.
Water Chamber—Through Manhole.

Plan of Inverted Heater looking through flue with Spiral removed.



Iron Spiral which fits into the flue.

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in which, besides eight principal London and forty-six Provincial daily papers, the Association inserted their advertisements. They also mentioned that Glasgow had now made a full subscription on the recognized basis, whereby their annual contribution amounted to £1000. It was also pointed out that the expense of this contribution in Edinburgh only amounts to a little over ½d. per consumer. Whether the proposal to have these advertisements in the local papers inserted over the name of the Gas Commissioners is a good one is perhaps questionable, as the general public have frequently communicated regarding general questions of gas consumption, whether for lighting or heating or cooking, when they have seen that the Association have no direct gain from the use of the apparatus in question. When, however, the advertisements bear upon the face of them the fact that they are issued on behalf of the gas suppliers, it is doubtful if their replies to such a question will carry the same weight. The gas supplier has always been looked upon as an enemy of the consumer, and popularly supposed only to recommend such apparatus as will increase the gas bill. It was on this account that a central Association, who were not themselves suppliers of gas, were looked upon by the general public as a safe instructor, and their statements more generally accepted.

The last stage of the Musselburgh question has now been reached, when Lord Anderson made perpetual the interim interdict formerly granted. The Town Council are now debarred from letting or feuing the piece of ground lying between the gas-works and the sea which was desired by the Gas Company for an extension of their works. It seems a pity that the gas-works should not be extended, as the position is an excellent one, so far as its distance from the town is concerned. On the other hand, the distance from the railway adds to the expense of gas making. It is now for the Company to seriously consider whether it would not be to their advantage gradually to remove the works from their present site to one where they could have a railway siding.

Some time ago Mr. W. Ritchie, the Gas Manager at Peterhead, was instructed by the Gas Committee of the Peterhead Town Council, who have been considering the question of introducing electric light and power, to ascertain what support such a scheme would receive. Mr. Ritchie stated that the price of electricity would be from 3d. to 4d. per unit for lighting. This compared with from 7s. 6d. to 10s. per 1000 cubic feet for gas, against the present price of 3s. 8d. Mr. Ritchie also wisely referred to the expense of wiring and fitting the house, which would cost approximately 22s. 6d. to 26s. per light. The result of this plebiscite is that 68 householders have intimated that they are willing to have electric light and power introduced into their premises; while 482 have replied in the negative. The remainder of the householders have not replied; and they are therefore held as being against the proposal. In view of the fact that altogether 3267 circulars were issued with only such a poor response, it is clear evidence that, even at the price mentioned, the wise folk of Peterhead are not prepared to go to the expense of fitting up their houses or premises to obtain the doubtful benefits of electric light and power. Surely this result will make the proposers of the various schemes for introducing electric light into other towns in the North of Scotland very chary of expending the ratepayers' money.

The Inverkeithing Town Council have now obtained the authority of the Sheriff to register in the Sheriff Court books of the county the resolution of the Town Council adopting the Burgh Gas Supply (Scotland) Act, 1876. This publication is required by the Statute, as the day of registration is held to be the day of the adoption of the Act.

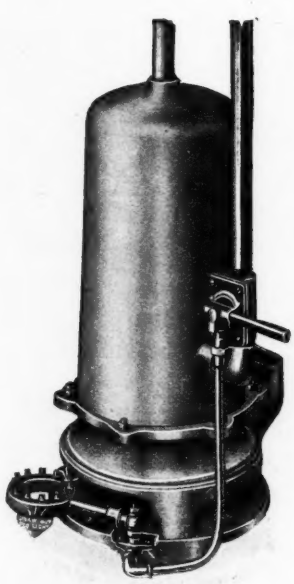
The Secretary for Scotland has now sanctioned the borrowing of £50,000 for extension at the Greenock Gas-Works. These extensions include a new system of vertical retorts. The matter has been delayed for some time owing to the action of a minority of five members of the Corporation who objected to the proposed extensions. They considered that the 64 Hislop retorts should be duplicated, and disputed the statement that the increase in the make of gas had been 31 per cent. The Town Council pointed out that the proposed new system was much more economical than horizontal retorts, and that they would be foolish to spend money on anything but the most economical plan.

The Nairn Gaslight Company have been holding an exhibition of lighting, cooking, and heating apparatus in the Public Hall. The opening ceremony was performed by Mr. John Gordon, the Chairman of the Gas Company. He said that gas was introduced into Nairn in the forties of the last century for illuminating purposes only, and up to about 25 years ago it had been employed for this purpose alone. Now, however, there were many other uses to which gas could be put, both for convenience and economy.

The plans of the alterations and extensions for the Hamilton Gas-Works, which it is estimated will cost £21,000, were before the Dean of Guild Court yesterday, when the plans were passed. The work consists of a building capable of accommodating 24 vertical retorts. Two chimney stacks will be required—one 120 feet and the other 90 feet high.

Wrexham Gas Company.—The death of the late Engineer and Manager (Mr. Joseph Braithwaite) was alluded to in feeling terms by Mr. J. O. Bury, who presided at the annual meeting of the Company. The remodelling of the works, begun in 1897 and completed a few days before his death, were, he said, a fitting monument to the great skill and ability of Mr. Braithwaite, who would also always be remembered as the prime mover in the adoption of the co-partnership scheme which had accomplished so much to the mutual advantage of the consumers, the Company, and the co-partners. The Directors had appointed in his place Mr. Owen Evans, who had been nearly fifteen years in the Company's service, and for five years was Assistant-Manager. In addition to his high qualifications as gas engineer, Mr. Evans had the great advantage of acquiring a sound practical knowledge of the duties of a gas manager, under the able instruction of Mr. Braithwaite; and he had given the Directors complete satisfaction since his appointment. A dividend of 5 per cent. per annum was declared; the Chairman pointing out that this dividend had not been fully earned, but there were accumulated profits enough to make up any deficiency.

The Maintenance of the IRONCLAD ends where it begins.



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WARRINGTON AND LONDON.

The FIVE PARTS of the IRONCLAD.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

The market for tar products has been firm during the past week. Efforts further to lower the price of pitch have not succeeded, and the value remains at 38s. 6d. net per ton. It is understood that the quantity of pitch sold at the lower prices for this season's delivery is not important.

Other values are: Creosote, in bulk, 3⅜d. net. Benzol, 1s. 2d. net and naked. Toluol, 1s. net and naked. Solvent naphtha, 10⅜d. net and naked. Sixties crude carbolic acid, buyers at 1s. 1d. to 1s. 1½d., sellers 1s. 2d. net, casks free. Anthracene, 2d. per unit for 45-50 per cent. quality. Pyridine, 8s. 3d. to 8s. 6d. net in buyer's packages.

The market for sulphate of ammonia is quiet, and the price remains at £12 net for 25 per cent. minimum quality, in buyer's bags ex maker's works. The outlook for the near future is that the demand will be equal to the production of sulphate.

Manchester Tar Prices.

It is officially announced that the average price realized for February deliveries of tar in the Manchester district—based on the value of the products—was 32s. 5d. per ton.

Tar and Tar Products in the Provinces.

The average values during the week were: Tar, 25s. 6d. to 30s. 6d. Pitch, east coast, 37s. to 37s. 3d.; west coast, Manchester, 36s. to 36s. 3d.; Liverpool, 36s. 6d. to 36s. 9d.; Clyde, 36s. 6d. to 37s. 6d. Benzol, 90 per cent., naked, North, 10⅛d. to 10⅜d.; 50-90 per cent., naked, North, 10d. to 10½d. Toluol, naked, North, 10½d. to 11d. Crude naphtha, in bulk, North, 4⅜d. to 5⅛d. Solvent naphtha, naked, North, 9⅛d. to 9⅜d. f.o.b. Heavy naphtha, naked, North, 9d. to 9⅛d. f.o.b. Creosote, in bulk, North, 3⅛d. to 3⅜d. Heavy oils, in bulk, 3⅜d. to 4d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 0⅛d. to 1s. 1d. Naphthalene, £4 10s. to £10; salts, 55s. to 60s., bags included. Anthracene, "A" quality, 1⅛d. to 1⅜d.; "B," nominally ¾d. per unit, packages included and delivered.

Sulphate of Ammonia Prices in the Provinces.

LIVERPOOL, *March* 21.

During the past week the tone of the market for this material has become quieter again, and the advance in prices, which recently took place, has been lost. There has been a good demand for home consumption, but new orders from foreign buyers have not been plentiful. The nearest values at the close are £12 7s. 6d. per ton f.o.b. Hull, and £12 8s. 9d. to £12 10s. per ton f.o.b. Liverpool and Leith. There is still little animation in the forward position, and no first-hand business has been recorded; the views of producers and those of buyers remaining too divergent.

From another source it is reported that the market for sulphate of ammonia during the past week has been somewhat quiet. Orders from abroad have been very scarce, but on the whole prices have remained about the same. Outside London, makes are quoted at £11 15s.; Hull, £12 7s. 6d.; Liverpool, £12 8s. 9d.; Leith, £12 10s.; Middlesbrough, £12 7s. 6d.

Nitrate of Soda.

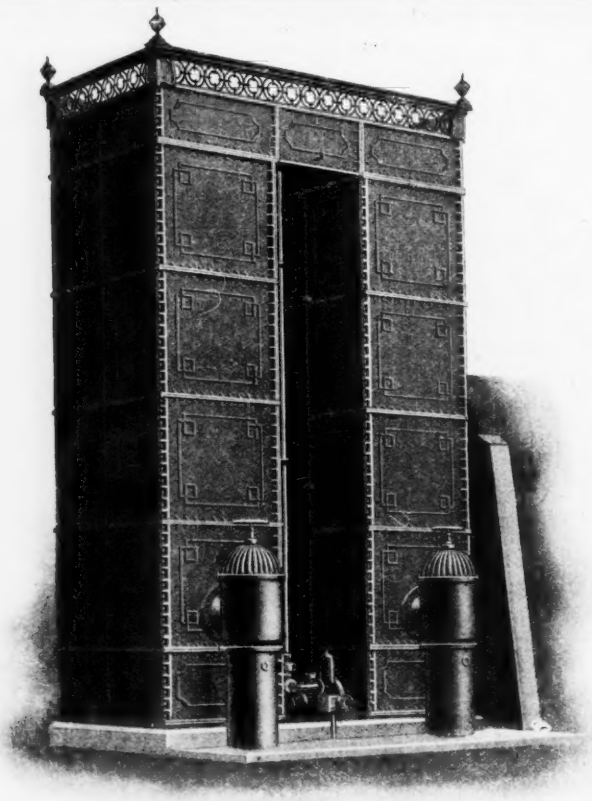
The market for this article is quiet but fairly steady, and spot quotations are repeated at 10s. 7½d. and 10s. 10½d. per cwt. for ordinary and refined quality respectively.

COAL TRADE REPORTS.

Northern Coal Trade.

The possibility of serious labour disputes in Yorkshire has stiffened the northern coal trade, and rendered forward business uncertain. In the steam coal trade, best Northumbrians are 13s. 6d. to 13s. 9d. per ton f.o.b.; second-class steams are 11s. per ton; and steam smalls are somewhat dearer at 6s. 6d. to 8s. per ton f.o.b. There is more tendency to firmness for forward sales from the cause named above. In the gas coal trade, there is a rather smaller consumption. For early delivery, best Durham gas coals are about 13s. 3d. to 13s. 4½d. per ton f.o.b.; second-class are 12s. to 12s. 6d.; and "Wear specials" are firm at 13s. 6d. to 13s. 10d. per ton f.o.b. In regard to contracts, it is reported that one of the great London Gas Companies has begun its purchases, and has made a contract for second-class Durham gas coals for delivery over a year from the 1st of July. The price is variously stated as from 11s. to 11s. 3d. per ton f.o.b.; but these are by no means official figures. It is thought that other contracts will be soon reported for the great buyers; while some lots for northern ports are in treaty. Coke is rather firmer; the output being less. Gas coke is little changed; and the price is about 13s. 6d. per ton f.o.b in the Tyne.

Another Award to a Banbridge Gas-Worker.—Awards have already been made to Hugh Adamson, from the Carnegie Hero Fund and the Society for the Protection of Life from Fire, in recognition of his bravery in rescuing the late Mr. G. Mearns (the Manager of the Banbridge Gas-Works) from a burning building, on the occasion of an explosion. A communication has since been received by the Secretary of the Gas Company, intimating that the King has been pleased to approve the award of the Albert Medal of the Second Class to Adamson in recognition of his act of gallantry. Adamson, though severely burned, dashed into the burning building, and dragged Mr. Mearns through a window to a place of safety, after which, at grave risk, he crawled to the chief gas-main and turned off the supply.



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Torquay Gas Company's Assessment.

The annual meeting of the Torquay Gas Company was held on Monday of last week—Mr. R. P. Kitson presiding. The accounts showed receipts of £36,644; and the Directors recommended the usual dividends of 10 and 7 per cent. The Chairman said that during the last half year the Board had been able, for the present at any rate, to close a matter which had required their serious attention for some years. In August, 1911, they received intimation from the rating authorities of their intention to increase the assessment. The Directors' opinion was that the rating value of the Company's property was already somewhat over-estimated by the then existing assessment; and they felt it necessary to oppose any increase, and his opinion was confirmed by their Secretary and Manager. Further, the advice of leading experts was obtained, as a result of which it was decided to appeal. Negotiations with the authorities followed, and were continued for about eighteen months. Eventually it was admitted by the authorities that the Company's position called, not for an increase, but for a reduction. The authorities offered a reduction of £400 net; and this the Directors accepted for the time being. The reduction operated as from the time of lodging the appeal; and the authorities had refunded the excess paid during the three previous half years. It might yet be seen, on consideration of the figures as they affected the rating question, that the reduction arranged should be greater; but the expense of a contest had been avoided, and the right to appeal further kept open, if this course was found advisable. Mr. A. Iredale, in seconding the motion for the adoption of the report, observed that, notwithstanding the increased charges during the past few years, the Company were supplying consumers with gas at 3d. per 1000 cubic feet less than three years ago, and at the same time maintaining the dividends. The report was adopted.

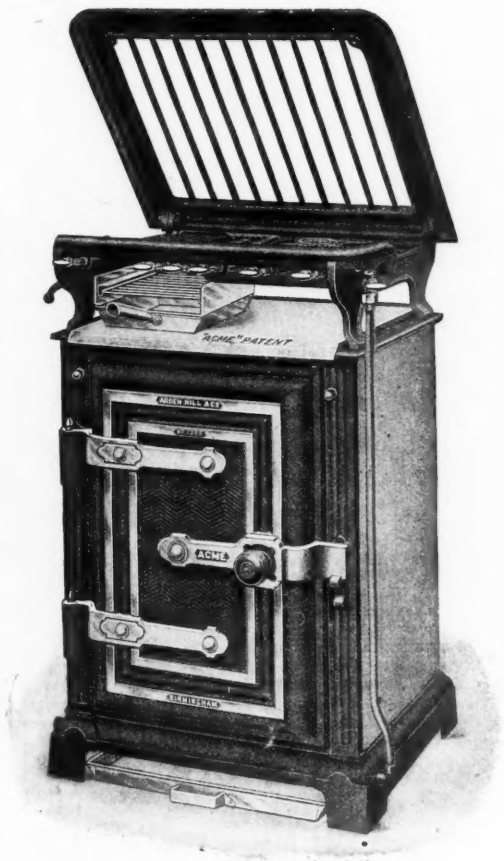
Price of Gas for Power at Southam.—The Directors of the Southam Gas Company have decided to make a special reduction of 20 per cent. on the price of gas used for engines, making the net charge 4s. per 1000 cubic feet. For other purposes, the price is to remain unaltered.

Neath Gas Undertaking Finances.—An exhaustive inquiry has been made by Messrs. Walter Hunter and Co., of Newport, into the accounts of the Neath Corporation Gas Department for the nine months ended Dec. 31 last; and after a careful examination of the system of book-keeping that is in use, they express the opinion that it is quite inadequate for properly recording the accounts of so large a public undertaking. They recommend the appointment of a financial officer, who should be independent and directly responsible to the Committee; this officer to supervise and check all transactions in connection with the undertaking. The report of the Auditors has been referred to the Gas Committee, who "will confer with the Auditors and the collector at the works, at a meeting open to all members of the Council, and report to the next monthly meeting of the Council."

Waterford Electric Lighting Scheme.

Mr. G. B. Deane, representing the Board of Trade, recently held an inquiry at Waterford into the application of the Corporation for a Provisional Order under the Electric Lighting Acts. The Waterford Gas Company opposed; and Mr. R. Bruce Anderson (the General Manager) stated that, in the opinion of the Company, the scheme would be unprofitable, and would tend to directly hit clients of the Gas Company as ratepayers, and also to the extent of four-fifths of any additional rate that the Company might have to pay through the improvidence of the scheme. Mr. P. Kent, the Borough Treasurer, said the valuation on the Gas Company's premises amounted to £1749; and that, with a rate of 11s. 2d. in the pound, the total annual sum paid by the Company amounted to £976. Mr. Carrigan, K.C., for the Corporation, described the Company's objections as "untenable, unfair, and unprecedented," and said the Corporation were driven to action because of inquiries on behalf of the Dublin and South-Eastern Electricity Development Company as to an installation in the city, with a view to applying for a Provisional Order on their own behalf. Mr. Anderson, questioned, said £8000 shown in the Gas Company's accounts for last year was not a balance, but accumulated profits. The revenue account showed £4639 net profit for the year. They paid the largest dividend the law permitted—7½ per cent. A sum of £320 had been divided between the employees under a profit-sharing scheme. Mr. J. J. Patterson, Local Manager of the Company, said from experience which he had had in Queenstown, where the gas was in competion with the electric light, he could safely say that the poorer classes of consumers would not use electric light in preference to gas. Dr. O'Sullivan, a member of the Corporation, objected to a clause sought to be put into the Order to review the accounts after five years, or every successive three years. If the Gas Company, he remarked, reduced the price of gas to consumers, they increased it for public lighting. Objections to the proposed Order were tendered by residents and owners of property in the vicinity of the site suggested by the Corporation.

Monte Video Water-Works Company, Limited.—A satisfactory expansion of the business during the past year was reported at the annual meeting of this Company, when the Chairman (Mr. James Anderson) said that at the end of December the private services numbered 30,032, which was an increase of 2834 during the twelve months. Five years ago the total was only 16,536; so that within this period the increase has amounted to 81 per cent. Last year's net income in Monte Video was £123,091, to which had to be added the balance of £47,522 brought in from last year, and an income of £1613 from investments at head office. A final dividend of 5 per cent. was declared, making a total of 8 per cent. for the year, free of income-tax. In addition, £20,000 was added to the reserve fund, and £2000 to the staff provident fund—leaving £53,858 to be carried forward. An issue of 5 per cent. debenture stock was announced.



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"Super-Acme" Gas Cooker.

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Extra large oven.

Hinged and improved hotplate; taps in front; wrought-iron top bars.

Porcelain enamelled inside and out.

Nozzle outlet at back, leaving clear space on top of oven for loose enamelled tray.

All parts are standardized and are not nominally but **actually** interchangeable.

ARDEN HILL & CO.,
"Acme" Works,
BIRMINGHAM.

Sale of Stocks and Shares.

Messrs. A. & W. Richards sold by auction last Tuesday, at the Mart, Tokenhouse Yard, E.C., stocks and shares in two gas companies and one water company. A new issue of £15,000 of consolidated ordinary stock in the Lea Bridge District Gas Company was sold at prices ranging from £124 to £126 10s. per £100. The stock ranks for a standard dividend of 5 per cent., subject to the sliding-scale, equally with the existing similar stock, now receiving a dividend at the rate of 6½ per cent. per annum. A new issue of 500 £20 4½ per cent. preference shares in the Gravesend and Milton Water-Works Company realized from £21 5s. to £21 12s. 6d. each. The third new issue was in connection with the Grays and Tilbury Gas Company; there being offered 600 £10 "B" shares, ranking for a standard dividend of 7 per cent., subject to the sliding-scale, equally with the existing "B" shares, dividends on which for the three years ended Dec. 31 last were paid at the rate of £5 19s. per cent. per annum. The shares were sold (with dividend accruing from April 15 next) at £11 2s. 6d. each. An issue of £2000 of 4 per cent. perpetual debenture stock in the same Company was not disposed of. On Thursday last, £3000 of 5 per cent. stock (new issue) in the Heckmondwike and Liversedge Gas Company was offered for sale by public auction at the Freemasons' Hall, Heckmondwike. Of the stock £2000 worth was sold in varying lots at prices ranging from £112 to £112 10s. per £100; while the last £1000 worth was sold in £10 lots, the prices ranging from £11 4s. to £11 5s. per lot.

Conway Gas-Works Nuisance Case.—The decision of the Court of Appeal, as reported in last week's "Journal" (p. 755), on the action brought by Mr. Albert Wood regarding an alleged nuisance from the gas-works, was discussed in private last Wednesday by the Conway Town Council; and it is understood that they decided to accept the unanimous judgment of the Court of Appeal, which upheld the finding of Mr. Justice Joyce in favour of Mr. Wood. The Council will therefore have to take steps to abate the nuisance complained of.

Lewes Gas Company.—The Company's accounts show a profit on revenue account for the half year ended Dec. 31 of £1744. Dividends were declared for the six months at the rate of 5 per cent. upon the original capital stock, and at the rate of 3½ per cent. upon the additional capital stock. At the meeting, the Chairman (Mr. M. S. Blaker) said the Directors had found it expedient to consult Parliamentary Agents with reference to the Bill introduced by the Hayward's Heath Gas Company, some of the proposals of which they had regarded as constituting rather an encroachment upon the privileges of the Lewes Gas Company. However, after one or two interviews, a clause had been agreed upon whereby the supply of gas in bulk into any portion of the Lewes Company's district was not to take place without the consent in writing of the Lewes Company. About 2 million cubic feet more gas was sent out in the past half year than in the corresponding period of 1912.

APPLICATIONS FOR LETTERS PATENT.

5887.—Scott, G. L., "Portable gas-stoves." March 9.
5888.—Hall, I., "Atmospheric burners." March 9.
5893.—Ferguson, W. B., and Renwick, F. F., "Bar photometer." March 9.
5986.—Power Gas Economy, Ltd., and Huessener, K., "Manufacture of producer gas." March 9.
5992.—Mastaing, H., and Monnier, L., "Gas-retorts." March 9.
5999.—Hall, T. S., "Geysers." March 10.
6017.—Coventry, W., "Mantle-holders." March 10.
6061.—Schuster, N., and British Coke-Ovens, Ltd., "Removal of heavy hydrocarbons and ammonia from gas." March 10.
6095.—Mastaing, H., and Monnier, L., "Gas-producer furnaces." March 10.
6112.—Waddell, A., "Vertical retorts." March 10.
6113.—Waddell, A., "Charging vertical retorts." March 10.
6159.—Novitas Fabrik Elektrischer Apparate Akt.-Ges., "Lighting and extinguishing gas-lamps." March 11.
6178.—Fry, A., and Flaherty, W., "Injectors for burners." March 11.
6233.—Rose, A., and Bellamy, W., "Atmospheric burners." March 12.
6257.—Drysdale and Co., Ltd., and Gauldie, K., "Compressing gases." March 12.
6286.—Chemische Fabriken Dr. Kurt Albert and Berend, L., "Tar-oil preparations." March 12.
6297.—Braun, H. C. H., "Pipe-joints." March 12.
6319.—Trezise, J. M. G., "Photometers." March 12.
6385.—Keith, J. & G., "Gas-lighting torch." March 13.
6388.—Duncan, J. R., "Pumps, meters, &c," March 13.
6397.—Stenning, H. A., and Stirling, J. H., "Pipe-joints." March 13.
6412.—Brett, C. G., and Henneberger, F., "Gas-stoves." March 13.
6434.—Carruthers, F. J. C., "Carburetting air." March 13.
6468.—Richmond Gas Stove and Meter Company, Ltd., and Jones, S. F., "Gas-grilling apparatus." March 14.
6482.—Hall, T. S., "Geysers." March 14.
6512.—Pascher, F., "Pipe-joints." March 14.

An application has been made to the Local Government Board by the Harrogate Corporation for their sanction to a loan of £7300 for water-works purposes.

The sale by tender of £55,000 of "B" stock in the Tottenham District Light, Heat, and Power Company resulted in tenders for £90,250 being received, at prices ranging from £115 to £120. The average price realized for the stock was £116 10s. 9d.

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SIMPLICITY—of construction.
EFFICIENCY—of the highest degree.
DURABILITY—cannot rust.
LOW COST—purchase and maintenance.

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THE PARKINSON STOVE CO., LTD.
(Incorporating Maughan's Patent Geyser Co.),
BIRMINGHAM & LONDON.

Bangor (Co. Down) Gas Profits.—At a meeting of the Bangor Urban District Council last Wednesday, it was reported that the amount to be contributed from the profits of the gas undertaking for the year ending this month towards defraying expenses incurred and payable by the sanitary authority, would be £798.

A Coke Sale at Congleton.—At the close of a meeting some days ago of the Congleton Gas Committee, Mr. Harper is reported to have "asked a very pointed question relative to a transaction in coke." The ensuing discussion took place in private; but it is stated that Alderman A. J. Solly (who was presiding), after giving a heated reply to Mr. Harper, handed in his resignation as Chairman of the Committee, and proposed that Mr. Harper should take his place. The Mayor remarked that he felt sure all the members of the Council had every confidence in the Chairman; and he moved that the action of the Gas Manager (Mr. J. T. Broughton) and the Chairman be confirmed in making what was an extraordinary sale. This was carried; and Alderman Solly expressed his thanks, and said he would do his best in future, though under the same conditions he would again act as he had done. It would not be as good a policy to reduce the price of coke all round as to make a special sale.

Bexhill Water and Gas Company.—During the half year ended Dec. 31, the Company experienced an increase of 5½ per cent. in the revenue from gas, and of 3½ per cent. in the revenue from water, on the large gains reported for the corresponding period of 1912. The accounts which will be submitted at the meeting on Thursday show a balance to credit of profit and loss account available for dividend of £7001. The Directors recommend a dividend for the six months at the rate of 6½ per cent. per annum on the capital authorized by the Acts of 1885 and 1892, and at the rate of £4 11s. per cent. per annum on the capital authorized by the Act of 1896, Order of 1901, and Act of 1904—less income-tax. This will leave £3149 to be carried forward. Acting under the advice of Mr. A. F. Phillips, the Directors have entered into a contract for the erection of a new retort-house, with all modern improvements, instead of extending the existing house, as previously contemplated.

The Marsh Gas Outbreaks in Bradford.—Some questions with regard to the recent outbreaks of marsh gas in Bradford were put to the Chairman of the Finance Committee at the last meeting of the City Council. He was asked (1) if the Corporation were in any way responsible for taking steps to avoid a catastrophe which might happen from the emanations of marsh gas in the Manningham district; (2) if the Corporation were not responsible, who was; (3) if anything had been done to bring home to those who might be responsible the duty of doing something, and, if so, what had been the replies or the results. On behalf of the Chairman, Alderman Johnson said the answer to the first question was that the Corporation were in no way responsible. The reply to the second question was that he could not say who was responsible; and to the third, that investigations had been made by the Gas Deparment and the City Engineer's Department, and were being continued. If anything could be done it would.

GAS COMPANIES IN THE STOCK EXCHANGE.

The Stock Exchange has had another depressed week. This cannot be wondered at, seeing the present critical state of affairs into which the nation is plunged. With that staring us in the face, all other points of disturbance—labour questions at home and French, Mexican, and Brazilian troubles abroad—seemed almost to fade into insignificance, and Ulster was the obsessing theme in the minds of all. It is nevertheless strange that on Saturday (after five days of progressive gloom) markets were really a little firmer, as if persuaded that civil war in what was once Merrie England were an unthinkable impossibility. On balance, however, all but the American closed at a loss on the week. The opening on Monday showed a marked depression; Mr. Churchill's bellicose oration at Bradford not advancing the prospect of a settlement. Government issues gave way; Consols falling ¼ for money and for the account. Fresh labour unrest set Rails back; Continentals selling lower. Transatlantics and Foreign were dull. Tuesday opened dismally in view of Government threats regarding Ulster, labour affairs, and the French situation. Gilt-edged went down, though they stiffened a bit later on, and Consols were ¼ lower for the account. But Transatlantics strengthened after a doubtful start. Wednesday was much the same. Consols fell flat, and lost another ¼ for money and for the account. Most other leading markets were adversely influenced; but Transatlantics were again a conspicuous exception, and quite cheerful. Thursday started in gloom, under the shadow of sundry darkening factors. Consols pointed the way by falling to 74½; but hope reviving in the afternoon lifted them to 75 again, and they closed unchanged. The other chief departments were not strong. Friday opened very gloomily; the darkest apprehension regarding Ulster being dominant. For a while business was almost suspended, and all held their hands afraid to commit themselves. By degrees they breathed again more freely; and prices were not seriously hurt. Saturday brought about a better feeling, though it would be hard to say on what foundation. However, Consols touched 75 more than once, and closed at 74⅞ to 75¼—a loss of only ½ in the week. Rails regarded the labour outlook more calmly, Transatlantics were well supported on their side, and Foreign were brighter. In the Money Market, there was a good demand; but discount rates were easy. Business in the Gas Market was quite quiet, and presented no very marked feature beyond the fact that prices were slightly easier in one or two lines, as might be expected in these agitating times. In Gas Light and Coke issues, the ordinary was quiet at rather stronger figures; transactions ranging from 100¾ to 101¾. In the secured issues, the maximum marked 77 to 78½, the preference 96 and 97½, and the debenture 73¾ to 75. South Metropolitan was little dealt in, and realized from 110 to 111 (a fall of ½), and the debenture fetched 74¾. In Commercials, the 4½ per cent. changed hands at 106½ to 107½. Among the Suburban and Provincial group, that distressful undertaking in a distressful country, Alliance and Dublin, was done at 55 (a fall of 6), Brentford new at 205, British debenture at 91, South Suburban at 115½, Tottenham "B" at 115½, and (on the local Exchange) Liverpool "B" at 143½. In the Continental companies, Imperial marked 173 to 175½ (a fall of 1), ditto debenture 85, Union 81¼, and European 17⅞ to 18¼. Among the undertakings of the remoter world, Bombay made 6¾, Monte Video 11⅞, Primitiva 6½, ditto preference 5 and 5 1/16, ditto debenture 93¼, and River Plate 87.

OFFICIAL QUOTATIONS AT THE CLOSE OF THE WEEK.

Bank Rate (fixed January 29), 3 per cent. Last year, 5 per cent. Consols, 74¾—75¼. Previous week, 75¼—75½.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.	£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 15	2½†	Alliance & Dublin Ord.	55—60	−6	4 3 4	75,000	5	Dec. 11	6	Malta & Mediterranean	4⅜—4⅝	..	6 3 1
374,000	,,	Jan. 15	4	Do. 4 p.c. Deb.	78—81	..	4 18 9	250,000	100	Oct. 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	..	4 9 1
280,000	5	Oct. 15	7½	Bombay, Ltd.	6—6½	..	5 15 5								
50,000	10	Feb. 26	16	Bourne-mouth Gas & Water 10 p.c.	27½—28½	..	5 11 4	541,920	20	Nov. 27	4	Monte Video, Ltd.	11⅜—12½	..	6 10 8
352,500	10	,,	7	B 7 p.c.	14½—15	..	4 18 4	1,775,892	Stk.	Feb. 26	4½	Newc'tle&G'tesh'd Con.	99½—100½	..	4 9 7
75,000	10	,,	6	Pref. 6 p.c.	13¾—14	..	4 5 9	529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	83½—84½	+½	4 2 10
380,000	Stk.	Feb. 26	14	Brentford Consolidated	256—261	..	5 7 3	55,940	10	Feb. 26	7/14.0	North Middlesex 7 p.c.	12½—13½	..	5 14 1
330,000	,,	,,	11	Do. New	202—207	..	5 6 3	300 000	Stk.	Nov. 27	8	Oriental, Ltd.	120—125	..	6 8 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	..	4 10 1	60,000	5	Sept. 26	10	Ottoman, Ltd.	7¼—7⅝	..	6 9 0
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	93—95	..	4 4 3	60,000	50	Feb. 25	13	Portsea, Island B	127—130	..	5 0 0
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	196—201	..	5 9 5	100,000	50	,,	12	Do. C	118—121	..	4 19 2
244,200	,,	,,	8	Do. A Ord. Stk.	145—148	..	5 8 1	249,980	5	Oct. 15	8	Primitiva Ord.	6⅜—6¾	−⅛	5 16 5
580,000	20	Sept. 26	12½	British	45—46	..	5 8 8	499,960	5	Dec. 30	5	,, 5 p.c. Pref.	5—5½	..	4 15 3
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	90—92	..	4 7 0	521,600	100	Dec. 1	4	,, 4 p.c. Deb.	93—95	..	4 4 3
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	89—91	..	4 7 11	346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	87—89	..	4 9 11
100,000	10	—	—	Cape Town & Dis., Ltd.	1—2	..	—	275,000	5	Sept. 26	12	San Paulo, Ltd.	—	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	2½—4½	..	—	150,000	10	,,	6	Do. 6 p.c. Pref.	10¼—11⅜	..	5 5 6
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	78—78	..	5 15 5	125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	106½—108½	..	4 12 2	135,000	Stk.	Aug. 28	10	Sheffield A	225—227	..	4 8 1
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	+½	5 1 2	209,984	,,	,,	10	Do. B	225—227	..	4 8 1
560,000	,,	,,	5½	Do. 3½ p.c. do.	103½—105½	..	5 1 1	523,500	,,	,,	10	Do. C	225—227	..	4 8 1
475,000	,,	Dec. 11	8	Do. 3 p.c. Deb. Stk.	71—73	..	4 2 2	90,000	10	Oct. 15	7½	South African	10¾—11½	..	6 10 5
800,000	Stk.	,,	4½	Continental Union, Ltd.	80—83	..	5 8 5	6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	109½—111½	−½	4 18 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	117—122	..	5 14 9	1,895,445	,,	Jan. 15	3	Do. 3 p.c. Deb.	73—75	..	4 0 0
492,270	Stk.	,,	6	Derby Con. Stk.	123—125	..	4 16 0	209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	155—157	..	5 8 3
55,000	,,	—	4	Do. Deb. Stk.	102—104	..	3 16 11	952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	..	5 3 5
1,002,180	10	Jan. 15	10	European, Ltd.	17½—18½	..	5 8 1	60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	..	4 9 3
16,386,660	Stk.	Feb. 12	4/17/4	Gas-light 4 p.c. Ord.	100—102	..	4 15 6	117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	113—115	..	4 6 11
2,600,000	,,	,,	3½	3½ p.c. max.	75—79	..	4 8 7	594,740	Stk.	Nov. 13	5	Southampton Ord.	101—104	..	4 16 2
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	95—98	..	4 1 8	120,000	Stk.	Feb. 12	7⅜	Tottenham A 5 p.c.	135—138	..	5 6 10
4,674,850	,,	Dec. 11	3	Coke 3 p.c. Con. Deb.	73—75	..	4 0 0	543,940	,,	,,	5⅝	District B 3½ p.c.	114—116	..	5 1 3
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89*	..	5 12 4	149,470	,,	Dec. 30	4	4 p.c. Deb.	89—91	..	4 7 11
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	16¾—17¾	..	6 7 6	182,380	10	,,	5	Tuscan, Ltd.	5—6	..	8 6 8
131,000	Stk.	Mar. 12	7⅛	Ilford A and C	147—150*	..	5 1 8	149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	95—97	..	5 3 1
65,780	,,	,,	6⅜	Do. B	115—118*	..	5 3 10	236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	103½—110½*	..	4 10 6
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	89—91	..	4 7 11					Wandsworth, Wimbledon, and Epsom—			
4,940,000	Stk.	Nov. 13	9	Imperial Continental	172—177	−1	5 1 8								
1,235,000	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	83½—85½	..	4 1 10	30,000	Stk.	Feb. 26	8⅜	Wandsworth A 5 p.c.	151—156	..	5 7 4
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	115—118*	..	5 10 2	255,636	,,	,,	6⅞	,, B 3½ p.c.	129—134	..	5 2 7
561,000	Stk.	Feb. 26	10	Liverpool United A	209—211	..	4 14 9	108,075	,,	,,	5/17/3	,, C 3½ p.c.	110—115	..	5 2 0
718,100	,,	,,	7	Do. B	142—144	+½	4 17 3	359,000	,,	,,	6½	Wimbledon 5 p.c.	108—113	..	5 8 3
306,083	,,	Dec. 30	4	Do. Deb. Stk.	99—101	..	3 19 3	98,000	,,	,,	6⅜	Epsom 5 p.c.	112—117	..	5 13 3
63,480	Stk.	Dec. 30	3	Maidstone 3 p.c. Deb.	65—67	..	4 9 7	88,416	,,	Dec. 30	3	3 p.c. Deb. Stk.	71—73	..	4 2 2

Prices marked * are "Ex Div." † Next Dividend will be at this rate.

While some men were engaged in repairing a cylinder at an engineering works in Bishop Auckland, by means of the oxy-acetylene process, the top of the cylinder was blown off by an explosion; a welder being fatally injured by the flying metal. A second man was less seriously hurt.

Mr. R. R. Thurlow, of Ipswich (late of the Anchor Tube Company, Birmingham, and since with Messrs. John Russell and Co., of Walsall), has resigned his position with the latter firm, and has joined the Wellington Tube Works, Limited, of Great Bridge, Staffs., whose interests he will represent in the Eastern Counties.

The recently issued report of Messrs. Stewarts and Lloyds, Limited, for the past year, shows an increase of £38,100 in gross profit, and of £39,200 in net profit, at £246,100. The deferred dividend is raised from 10 to 12½ per cent.; while £50,000 is placed to reserve, against £47,800 a year ago. On this occasion, £20,000 is set aside to the employees' benefit fund; and the carry-forward is nearly £5000 higher at £95,400.

The Haywards Heath Gas Company have placed an order with Messrs. Biggs, Wall, and Co., for an installation at the gas-works of their "Rapid" manual charging machines.

The Bridlington Gas Company, in conjunction with the Richmond Gas Stove and Meter Company, Limited, have been demonstrating to the gas consumers of Bridlington, with marked success, the advantages of gas cooking and heating. A large number of orders were taken through the medium of a comprehensive exhibition and a thorough canvass of every consumer not at present using a gas-cooker.

Next Tuesday, at the Mart, Tokenhouse Yard, E.C., Messrs. A. & W. Richards will, by order of the Directors, sell by auction £7500 of consolidated ordinary stock in the Rochester, Chatham, and Gillingham Gas Company. The stock will rank for a standard dividend of 5 per cent., subject to the sliding-scale, equally with the existing similar stock of the Company, now receiving a dividend at the rate of 5½ per cent. per annum. The forthcoming sale will be the first time the Company have offered stock on the London market.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

DRAUGHTSMAN. R. & J. Dempster, Manchester.
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RETORTS. Newcastle Gas Company.

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GASHOLDER. W. P. Thompson and Co., 6, Lord Street, Liverpool.

Sales of Stocks and Shares.

AYLESBURY GAS COMPANY. London Mart. March 31.
DORKING GAS COMPANY. London Mart. March 31.
ROCHESTER, &c., GAS COMPANY. London Mart. March 31.
SUTTON GAS COMPANY. London Mart. March 31.

TENDERS FOR

Coal.

NEWPORT (FIFE) GAS DEPARTMENT. Tenders by April 1.
ROCHESTER, CHATHAM, AND GILLINGHAM GAS COMPANY. Tenders by April 8.

Coke.

WANDSWORTH, &c., GAS COMPANY. Tenders by March 27.

Tar.

COLNE GAS DEPARTMENT. Tenders by April 11.

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